RAILROAD GAZETTE

FRIDAY, OCTOBER 16, 1896.

CONTENTS

Contributions.

The Grand Central Interlocking.

The National Switch & Signal Co.,
EASTON, Oct. 6, 1896.

TO THE EDITOR OF THE RAILROAD GAZETTE:

We notice in your issue of Oct. 2 a letter from Arthur Johnson, dated London, Sept. 15, and are somewhat surprised to note that you make no editorial comments on the same. You will find by a perusal of the pamphlet issued by the New York Central that Mr. Johnson's statement is entirely incorrect; there is no description in the same which indicates that the Grand Central Station plant was installed by the National Switch & Signal Co. The only thing that is credited to us is the latest installation on the New York Central, which at that time was the Syracuse plant, which was installed by us, and the locking shown on page 40, Fig. 13, is the example referred to in the last paragraph of page 39.

It seems hardly necessary for us to deny that the National Switch & Signal Company's machine is an imitation of the Johnson, for although we now own and have owned the Johnson machine and plant for over one year we have found no orders for same, while we have installed some of the largest plants in the country, using the National standard, which differs materially from the Johnson.

The pamphlet referred to by Mr. Johnson was edited and published by the New York Central Railroad entirely without our knowledge, and it was not intended to advertise any of the devices furnished by the several signal companies, its object being to give the public a general description of the safety appliances furnished by that company.

CHARLES HANSEL,
Vice-President and General Manager.

[It is evident enough that the language of the pamphlet is obscure and is susceptible of the interpretation which Mr. Johnson put on it. We print an extract containing the words of which Mr. Johnson complains:

"At the Grand Central Station there are approximately 66 signals, 80 switches, 46 facing points detector bars and locks, 4 spare levers and 4 spare spaces.

"Fig. 13 is a diagram of the interlocking mechanism with the intermediate circular division pieces carried by the tappets and between the locks.

"This is the most recent interlocking installation on the New York Central, and was put in by the National Switch & Signal Co, of Easton, Pa."

The plan of the tracks, etc., is Fig. 12 facing the paragraphs quoted. Fig. 13 is over the leaf, and it is easy to see how a reader would naturally assume that the second paragraph referred to a detail of the machine spoken of in the first paragraph. The third paragraph, speaking of an "installation," would hardly be connected with a diagram of a small part of a machine.—EDITOR RAILROAD GAZETTE.]

Electric Resistance of Cast-Welded Joints.

OSWEGO, N. Y., Oct. 7, 1896.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Your favor of the 2d inst., concerning the performance of the cast-weld joints is received. About two years ago I witnessed a test of this joint at the Edison Labratory; from 1,000 to 1,500 amperes were put through a joint of 60-lb. rail and the drop when new was about equivalent to a new No. 0000 copper bond. After about two months underground with no current and no service, the tests were repeated and the conductivity had fallen below that of a No. 00 wire. As I have said elsewhere, I consider this joint an excellent thing mechanically when used on paved streets, for the reason that it is *not* a weld and therefore allows a margin for expansion and contraction.

Recently I have seen the report of careful tests of several hundred of these joints that had been in service about 18 months. These joints were bonded with copper wire when put down, and I suppose that some of the wire is still there. But the two tracks, which would return at least 100 amperes per rail, were the actually continuous, have barely 15 amperes per rail. Even with this small current the drop of one foot of rail including the joint averages 3 to 10 times the drop of one foot of rail between joints.

These tests were made with special Weston instrument which accurately indicated as low as 0.0001 of one volt. Some of the joints showed as much as one volt drop. I quote the following comments from a letter written by a friend who made the examination above mentioned:

"I have seen a report of test of a sample cast-weld joint, which had never been underground nor in service, in which was used a voltmeter reading 0.01 per degree, while the observed drop was expressed in decimals to the fourth place! Also another test, with same instrument, in which the drop of about 2,000 ft. of double track was measured with less than 120 amperes current, from which it was apparently assumed that the current flowed upon two rails only, and that none was carried by cross-bonds, by the earth, nor by pipes underneath. Here again the result is expressed in decimals beyond the reach of the instrument! I have personally gone over miles of track having this joint, taking readings as low as 0.0001 of a volt, measuring drop of one foot of rail, including joint and of one foot of same rail away from joint. I am forced to conclude that the character of the iron, of the climate, or of the instruments used, account for the widely differing results. My tests show that though this joint is mechanically most excellent, it is not a permanent bond and is not of low resistance on at least one road."

I am told that during the hot weather of last summer the electric-welded tracks which are still left in Brooklyn were distorted, while the cast-welded tracks in Newark were not disturbed in the same way. Both were on paved streets. This seems to indicate that the cast-weld is not a weld; but I do not think there is play enough at the joints to justify their use on exposed rails, which would, of course, be much more seriously affected by change of temperature. I, therefore, should be reluctant to use this joint for suburban service.

F. H. TIDMAN,
Gen. Man., Lake Ontario & Riverside Railway Co.

MINNEAPOLIS, Oct. 9, 1896.

TO THE EDITOR OF THE RAILROAD GAZETTE:

We will have at the close of this season's work, in the neighborhood of 30 miles of single track with cast-welded joints. About six miles of this was put in last year. We have made some comparative test on the resistance feature with results as follows:

Capacity of our standard bond plate	450,000 cir. mills.
Resistance as shown by this	.006 ohms per 1,000 ft.
Resistance of a 51-lb. rail, cast-welded joint	.0028
On a 45-lb. rail	.0036

W. J. HIELE,
General Manager, Twin City Rapid Transit Co.

Compressed Air vs. Electric Motors.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with much interest the communications of General Serrell and Captain Harris in the *Railroad Gazette* of October 2 on the compressed-air motor, but am much disappointed at the lack of information on the main points which I originally inquired about [*Railroad Gazette*, Aug. 21 and Sept. 4]. In Mr. Serrell's summary no figures of any importance are given. There are several sentences, however, that help a little toward the end sought.

"The body of the car is the same in both systems [compressed air and electric], the weight of the driving machinery is greater in the compressed-air system, but is susceptible of being lightened."

That is, the compressed-air motors are heavy. If we take Captain Harris' figures we find that the compressed-air apparatus weighs about 11,200 lbs. The electric apparatus for the same car would weigh but about 5,000 lbs. for a double equipment capable of pulling one or two trailers. Whether the heavier compressed-air apparatus will pull a trailer we are not informed. According to Captain Harris' data the weight of an empty car fitted for compressed air is 18,200 lbs. The weight of the electric motor car to haul two trailers is about 12,000 lbs. and allowing about 20 passengers as the average load for crowded traffic, the total loaded weight is 14,800 lbs. For the same load of passengers, and probably when equipped only to haul itself without a trailer, the compressed-air car weighs 21,000 lbs. In other words, for an average of city traffic the compressed-air car weighs 50 per cent. more than the electric, and for suburban traffic where the average load of passengers is less the compressed-air car would weigh more in proportion. Now, it is not fair in a serious consideration of this matter to omit the important fact that the greater weight will take more power. Under the most favorable circumstances it appears that the compressed-air motor car will use 50 per cent. more power. What will be the ratio when the compressed-air apparatus is made powerful enough to haul one or two trailers? So far those who have written in favor of the compressed-air motor have carefully avoided this point. General Serrell dodges the issue thus:

"The actual power to move the load is the same in each of the two systems, except that there is more dead weight in the car in the compressed-air method."

Just what this means is not clear, but one may be considerate and assume that what is meant is that the "actual power to move the load" *per ton of load* "is the same in each of the two systems." This will not be disputed, but what about the fact that the number of tons per car for the same same number of passengers is far greater?

It is important that General Serrell thinks, having all the data available, that "it is open to doubt which loses the most force between the prime mover and the work done." This brings to naught one of the absurd claims made in the newspapers. It begins to look as if some of the claims in circulars and in the magazines were based on speculation, not on facts. General Serrell adds an interesting opinion about the use of compressed air at 4,000 or 5,000 lbs. per square inch, and believes with that pressure instead of 2,000 to 2,500 lbs. now used, "the work done will be a higher percentage of the energy generated than has ever been claimed for the trolley, particularly upon long lines." It will be long before the public will feel easy when sitting on tanks having 5,000 lbs. pressure per square inch, and one might suggest that these tanks will weigh somewhat more and there will need be some further expenditure of energy to haul them about. If the compressed-air motor is to wait for the use of such pressures before being as efficient as the trolley, investors who are offered compressed-air motor stock want to know it now. If we go beyond the present stage of development of compressed-air motors in our speculation, why not take up the promised developments in electric motors, with alternating currents, etc., and in this way be just to both systems?

General Serrell practically admits, and Captain Harris indirectly shows that the cost of installation in central station and line construction would be practically the same for the compressed air as for the electric. This is another conclusion that will interest the investor, and throw light on the claims made for less first cost.

Captain Harris gives just figures enough so that it is impossible for an engineer to reach conclusions as to the power and efficiency of the compressed-air cars in New York. He gives the distance run, the number of stops and reduction of pressure, but not the speed, the load or the amount of air used. It hardly seems possible, yet after all that has been published for engineers to read about compressed-air motors, one is forced to believe that the only basis for what has been said is such meager information that Captain Harris can only say after his investigation: "*The inferences drawn from witnessing its experimental operation are all favorable.*" No speeds, no weights, no estimate of the extra cost of hauling the enormous dead weight, but simply *inferences* drawn from witnessing the car move. Surely this is not enough for an engineer to be very enthusiastic about.

Gradually, by analysis of what has appeared in the communications in the *Railroad Gazette*, the original inquiry is being answered. I have been looking for useful information, instructive to engineers, but the conviction is growing that no such information is to be obtained and one must return to the opinion still held by many; namely, that some inventors and promotors have been so pleased to see the compressed-air car work freely under the easiest possible conditions that they have lost sight of what may happen when it the game is played for higher stakes and the compressed-air car is put beside an electric motor car and made to do the same work; or in other words made to do the work demanded by the public at the present time. A mule is a mighty useful animal for packing freight up a mountain trail, and as a hay burner is very efficient, but if we should expand the mule until big enough to haul an express train, he might, in comparison to the steam locomotive, have some uneconomical, if not uncomfortable, traits. What we want to know about the compressed-air motor is, will it be like the expanded mule when it is made big enough to haul a motor car and one or two trailers in the same hard service that we see every day around in the public streets? This sort of information is not forthcoming, although if compressed-air motor inventors know as much about their machines as they claim, it would be a simple matter to tell the comparative total weights of the electric and the compressed-air car to do the same work. When these weights alone are at hand, leaving aside other matters, an important step in learning something about the relative efficiency of the compressed-air and electric motor systems will have been taken.

INVESTOR.

Elevation of Rail on Sharp and Flat Curves.

Chicago, Milwaukee & St. Paul Railway Co.,
CHICAGO, Sept. 29.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Professor Allen, referring to the table for elevating the outer rail on curves, which was prepared and recommended by a committee of the Road Master's Association, says: "In this table the elevation is directly proportional to the degree of curve." So is the elevation directly proportional to the rate of speed. Indeed, the rate of speed is the more important factor; for, at a low rate, super-elevation could be entirely dispensed with on any curve without serious results. The reason why elevation should be proportioned to the degree of curvature as well as to the rate of speed is that at a given rate of speed the centrifugal force increases as the radius of the curve decreases. For instance, at a rate of 20 miles per hour the tendency to fly off at a tangent is much greater on a 2-deg. curve than on a 1-deg. curve, hence more elevation is necessary to overcome the centrifugal force.

Perfection in elevation of a curve would be reached

when it was so adjusted to both speed and curvature that a train would pass around it without concussion of the wheels against either high or low rails and without the unnecessary and unpleasant tilting of the coaches toward either the outside or inside of the curve. Approximate perfection in riding having been obtained, it would also be found that the wear and tear of rolling stock and wear of the rails, caused by the impinging of wheels, would be reduced to a minimum and the surface and alignment would be more easily maintained. The lurching and pounding of wheels with their great load against the outside rail is destructive alike to gage, surface and line.

In using the table referred to, the first thing a Roadmaster would do would be to ascertain the usual rate of speed of passenger trains over the curve to which he intended to apply it. This is frequently governed by natural conditions. Speed must necessarily be slow at or near the summit of a grade, while at the foot of a grade it would presumably be very fast. It is also frequently necessary to reduce speed of all trains.

Having determined by actual timing of trains the speed made, the Roadmaster would give the outside rail the elevation required for the ascertained speed for whatever degree the curve might be.

On first-class roads there is no reduction of speed on ordinary curves. By an "ordinary curve" is meant one around which the highest speed can be made with safety and comfort. The table prepared by the Roadmasters shows that in their opinion 1-deg., 2-deg., 3-deg. and even 4-deg. curves are entirely safe at very high speeds, but on curves of more than 4 deg. a limiting of speed rather than an increased elevation is recommended.

As illustrating the good results obtained on one road running out of Chicago by treatment of curves similar to that recommended by the Roadmasters, it may not be out of place to relate an incident that occurred a short time since. On a crowded train approaching Chicago, a gentleman, not being able to secure a seat, had been standing in the aisle of a coach for an hour, and as a trainman passed through remarked that "there are no curves on this road." The trainman asked why he thought so. The reply was, "Why, I have been standing here for an hour expecting every minute we would strike a curve, but I have not felt one yet." As a mattor of fact, the train had within the hour passed over eleven curves of from 1 deg. to 3 deg. at more than 60 miles an hour.

GORDON W. MERRELL.

SOUTH BETHLEHEM, Pa., Oct. 2.

TO THE EDITOR OF THE RAILROAD GAZETTE:

As the conditions, grades, speed of trains, etc., differ so much, it is apparently necessary in order to arrive at what is even approximately the proper elevation of the curves, to combine theory with practice. The first requirement for this is to have an elevation table for the various speeds made in accordance with the formula given in the text books. And then elevate for the required speed according to it.

After doing this, a practical test by careful observation of each curve and the effect of trains running over that different rates of speed should be made, and in this way determine definitely the proper amount of elevation to give, limiting it to a certain maximum height, which I now believe should not exceed 9 in.

GENERAL ROADMASTER.

SPRINGFIELD, Sept. 30.

TO THE EDITOR OF THE RAILROAD GAZETTE:

My experience has been that it is not always possible to elevate the outer rail of a curve as per the speed given in the time table, as locomotive engineers do not always run at an even rate of speed, particularly on a descending grade. We elevate the outer rail of a certain curve for what we think the velocity of the fastest trains will be upon this curve. If we find that trains acquire a greater velocity on the curve than it is elevated for, we put in a little more elevation. I think I am safe in saying that in practice on this road the easy curves have slightly more elevation than sharp ones in proportion to the degree of the curve, which I think may partly be due to the increased velocity on same, and perhaps partly to the aversion to putting in so much elevation on sharp curves when freight trains are run over the same track at a slow rate of speed. R. M.

Chicago, Burlington & Quincy Railroad Co.,
CHICAGO, Oct. 6.

TO THE EDITOR OF THE RAILROAD GAZETTE:

As stated in Mr. Allen's letter, "it it is not probable that an engineer, in making his run over a division, will run with a uniform speed over the entire distance." This variation of speed, however, is not often caused by sharp curves, but is due to various other causes. At the present time our important passenger and freight trains are expected to make about as fast time as possible over the entire road or division, but owing to the different gradients it is impossible to maintain a uniform speed. In addition to this, trains are many times obliged to run slow through important towns and also when nearing grade crossings with other roads, and often owing to the track and bridges being temporarily in bad order; but, as stated above, very rarely indeed for sharp curves, it being the practice when locating a line to use only curves of such a degree of curvature that are safe for the fastest trains. This rule is undoubtedly varied from in very mountainous countries.

The article on the resistance of cars on curves, published in the *Railroad Gazette* Sept. 1 and 8, 1893, gives the most practical account of the performance of cars on very sharp curves, with and without outer elevation, that has come to my notice.

Among the conclusions arrived at when making experiments on a track built especially for that purpose was that "under the most unfavorable conditions, a passenger car with seats on the roof, the overturning on a curve of 328 ft. radius on the normal gage, and without any super-elevation, would take place at a speed of 46.6 miles per hour." In the same article the following statement is also made: "From the standpoint of shocks, and the tendency to derailment, all observations made at these speeds, even to that ranging from 37 up to 41 miles per hour, have shown that the passage over curves of 328 ft. radius, as well as the passage from one curve to another in opposite direction or over a reverse curve, can be accomplished with very great smoothness." If we are to be guided at all by these practical experiments, we must conclude that the necessity of running slow over what are considered sharp curves, *i. e.*, curves varying in degree of curvature from 5 degs. to 12 degs., is small.

There are cases, however, when a sharp curve is located at the foot of a long or steep grade when it is necessary to hold the train under control and not allow the train to pass over the curve at the speed which it would attain if not held under control. These conditions are not common, and when they do occur, the safe speed over them generally equals the average speed under other conditions. In the formula used in compiling the table referred to in the report of the Committee on Elevation of Curves at the Road Masters' Convention, the velocity is the only varying factor when determing the elevation of a curve with a given radius, and if the formula is followed, the error referred to by the section foreman in Mr. Allen's letter will be avoided, as all curves will be elevated to accommodate the average speed of first-class trains over them.

H. G. HETZLER, *Roadmaster.*

PITTSBURGH, Pa., Oct. 5.

TO THE EDITOR OF THE RAILROAD GAZETTE:

A passenger train on a fast schedule, when grades do not interfere, makes the best time on tangents and light curves, treating the latter as parts of the tangents; but on heavier curves the brakes are applied before and during entrance to the curve, for the purpose of stretching out and steadying the train while "taking the curve." If, however, the curve does not require a reduction of the speed, an application of the air is all that is required for the purpose of steadying the train. etc As soon as the rear car has fully entered the curve, then the brakes are released.

In making a fast run, it is unusual for the enginemen to shut off the steam when "rounding a curve," controlling his train entirely by the air-brake. On slow runs it is quite usual to allow the engine to drift around the heavier curves without using steam.

There is no better guide to an engineman to properly handle a passenger train around different degrees of curvature than to equip his engine with a speed indicator located in the cab right in front of the engineman. When the writer was studying the matter of higher elevation on curves, he rode a great deal on a fast passenger engine specially equipped as above, and in a short time the engineman had a knowledge of the curves that could not otherwise have been obtained. He had stored up in his head the maximum speed for every curve on his run that could be made without shaking up or scaring the passengers. It is considered, among railroad men, a fine point for an engineman to enter a curve of from 5 to 10 deg. curvature with his train at a fast speed with comfort to the passengers. He who has acquired this knack is called an expert runner. Considering the care, judgment and experience necessary to accomplish this, the title is well earned.

The accompanying table of elevations is compiled, using the theoretical formula as far as practical, and maintain a maximum elevation of 9 in., which long practic, has demonstrated to be a safe limit for all kinds of trains, and especially with the present means of securing the track. The elevations for the high speeds are arranged so as not to make uncomfortable riding for the slow scheduled passenger trains. The elevation of 7 in on a 3 deg. curve has been tested at the highest speed, and proved comfortable riding.

TABLE FOR ELEVATING OUTER RAIL OF CURVES.

Speed 40 miles.		Speed 50 miles.		Speed 60 miles.		Speed 70 miles.		Speed 80 miles.	
Deg.	Elev. Ins.	Deg.	Elev Ins.	Deg.	Elev. Ins.	Deg.	Elev. Ins.	Deg.	Elev. Ins.
1	1	1	1½	1	2	1	3	1	4
2	2	2	3	2	4	2	5	2	6
3	3	3	4	3	5	3	6	3	7
4	4	4	5	4	6	4	7		
5	5	5	6	5	7	5	8		
6	6	6	7	6	8				
7	7	7	8	7	9				
8	8	8	9						
9	8½								
10	9								

Where the ends of curves are provided with spiral or transition curves, the point where the full degree of curvature is attained should have the full amount of elevation on the receiving end of curve, but the run-off end of curve need not have so much. Where the curves are simple without transition ends, the receiving end of curve should have more elevation than elsewhere, and the run-off end considerably less. In the first case the wheels or trucks are gradually set, and the centrifugal force similarly overcome, while in the latter case all must be done at once.

It is well to remember that elevation will not correct defects in line and surface. It is not put in the curve for that purpose. Line and surface are equally important with that of elevation, and when the three are correct it is surprising how little such a curve, though of heavy degree, interferes with the fast running of trains.

A. MORRISON.

How Electric-Railroad Equipment May be Simplified.

BY WM. BAXTER, JR.

The design of electric-railroad motors has been greatly improved during the last few years, but the other parts of the equipment have remained nearly at a standstill. While it is true that the series parallel controllers which have come into almost universal use are in some respects superior to those they replaced, the gain they have effected in one direction is largely offset by defects in another. In the early days of electric railroading, there were several makes of controllers of such design, that they required but one handle for reversing, as well as for controlling the motion in the forward direction. Since this simplicity can be adapted to the series parallel system as easily as it was to the rheostat and commutated field methods, it is not easy to understand why it was abandoned. About the only plausible explanation that can be given, is that the first designers of the modern controllers failed to see how to adopt it and hence resorted to the independent reversing-switch. This has remained in use, because the majority of railroad men have known no other, and, like the man who is born with one leg, they have become accustomed to what they have and do not miss that of which they know nothing.

The first railroad motors were similar in design to those used at that time for stationary work, and, on account of their being wholly unprotected, were frequently burned out through the destructive effect upon the insulation of the mud and water with which they were almost constantly covered. The first efforts in the way of protection consisted in placing a pan under the machinery; but while this served to prevent mud and water from splashing upon the vital parts, to a considerable extent, it also prevented that which happened to elude it from dropping to the ground, and thus did more harm than good. The next improvement was to hang canvas curtains around the sides, and these, in connection with the pan, proved moderately effective so long as they lasted. In the course of time the modern ironclad motors were brought out, and since then mud and water have ceased to be the terror which they were formerly. The machines of to-day are all that could be desired; they close up like a clam shell, and, although they may be completely covered with mud on the outside, are perfectly clean within and if properly protected against lightning, will not cost any more than stationary motors to keep in repair.

In addition to the improvement in design, the weight has been greatly reduced. While the early single reduction motors weighed from 3,000 to 3,500 lbs., those of to-day, with few exceptions, are under 1,500. In the first machines more than one-half the weight was carried on the axle, and, consequently, the hammering effect on the rail joints was very great; but now nearly all the weight is taken off the axle by the method of suspension used by some manufacturers. In any case, the amount that is not spring supported is very small—perhaps less than five per cent. of what it was formerly.

In view of all these decided improvements in the motors, one would naturally expect that the other parts would have kept pace with it, but such is not the case. Outside of the introduction of the series parallel controller, no improvements worthy of mention can be noted, unless it be in the construction of the cables and the change in location of the motor cut-out switches. In the early days, the wires were inclosed in a cotton hose, and as it was not an easy matter to slip this hose over the wires, providing they filled it up well, no effort was made to produce a snug fit. The arrangement was not sightly, neither was it substantial. At the present time, regularly made-up cables are largely used, and these are all that could be desired, both in appearance and durability. An improvement has also been made by some of the manufacturers in the location of the cut-out switches of the motor. In former days, these were placed under the seat of the car, and if it became necessary to cut out a motor, the motorman had to go into the car and ask the passengers to move in order to permit him to get at the switch. Most of the manufacturers now place these switches in the controller stand, which, although a decided improvement, is not the best that can be done. In all the devices now in use with which the writer is familiar, the controller casing must be removed whenever it is desired to cut out a motor; but it is possible to so construct these parts that the switches may be operated without removing the casing. The time required for the operation can thereby be shortened from one or two minutes to as many seconds, and all this can be accomplished with simpler mechanism than is now used. It may be claimed that unless controllers have been made, and used with the style of wiring shown in Fig. 2. They would, no doubt, be furnished by most of the manufacturers, if forced to do so by competition, or by universal demand. The trolley wire in Fig. 2, instead of running to a hood switch, as shown in Fig. 1, would go direct to one of the controllers, where it would connect with an emergency switch,

the motors are to be cut out very often, all this refinement is unnecessary; but even if they are not cut out more frequently than once in five years, it is desirable to use a mechanism by means of which the operation may be performed in a few seconds, especially if it is less complicated than that which is slower in action.

An examination of the remainder of the equipment will show that it is to-day substantially the same as it was when electricity first came into use, and a careful consideration of the subject will show that a large amount of the present complication is unnecessary and can be removed. The two diagrams shown herewith will serve to make this fact more evident.

Let us consider Fig. 1, which shows the various parts of the equipment generally used at the present time, and approximately their location with reference to each other. With this arrangement a wire is run from the trolley base, along the roof of the car, to the under side of the hood at one end. Here it connects with a hood switch, and then passes to the side of the roof and at any convenient point runs along to the other end of the car, where it connects with another hood switch. From this switch it passes down to the under side of the car and connects with the fuse box, and from this to the lightning arrester, thence to the kicking coil and finally to the cable that leads to the controllers. This path can be easily followed on the diagram, where the trolley wire is marked *T*, the hood switches *H*, the fuse box *F*, the lightning arrester *L* and the kicking coil *K*.

The hood switches are intended to be used in cases of emergency; that is, only when the car cannot be stopped by the movement of the controller handle. They were originally placed under the hood, as this was believed to be the best location and there they have remained ever since. Notwithstanding this, however, any one who has had experience with electric roads will admit that this is not the best location. In this position the switches are too much exposed and therefore too liable to be tampered with, and, being so far removed from the other apparatus used by the motorman in operating the car, are forgotten in most cases of emergency. If placed close to the controller, they would be in sight and therefore more likely to be used when necessary and at the same time would be less likely to be tampered with. In addition to these advantages, changing the location would also dispense with the wire which is now required to connect the two switches, providing the connections were made such as to take advantage of the change in position.

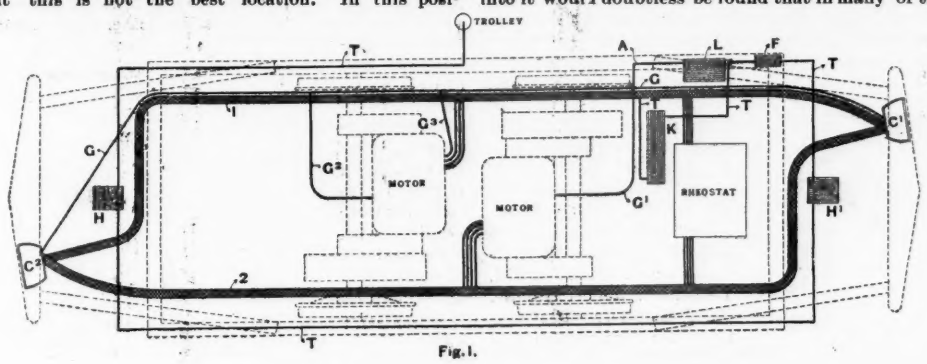


Fig. 1.

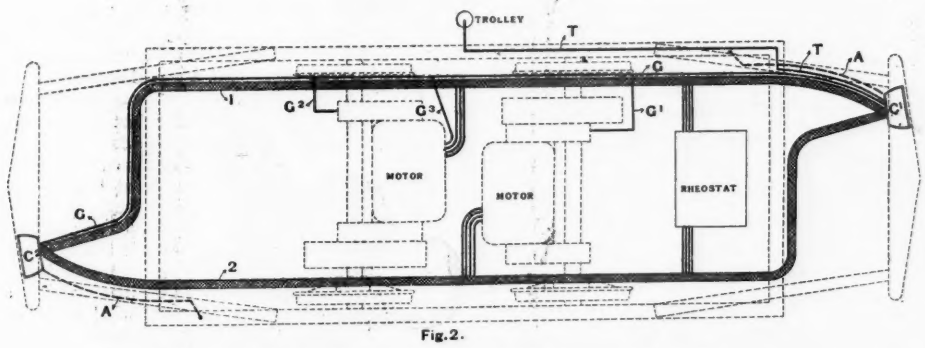


Fig. 2.

Suggested Simplification of Arrangement of Apparatus on Electric Cars.

The fuse box *F* is generally located under one corner of the car body, so that it may be easily reached by the motorman whenever it becomes necessary to insert a new fuse, but considering the conditions under which the fuses blow out, the present location is not the best one; and, furthermore, the present construction if slightly changed would insure greater safety.

A fuse, if properly secured in the holders, will never blow out, except with an excessive current, and such currents are only used when running up heavy grades with a large load. If under such conditions the fuse gives out, the car will be at the mercy of the brake, and if this should happen to be out of order at that time—which is not at all impossible—the car could not be prevented from running backward to the bottom of the hill and this might result in a serious accident. From considerations of safety, the fuse box should be located on or under the platform and in a position accessible to the motorman. In addition to this change in location, it should be of a modified construction and be provided with a switch to bridge over the gap, so that if the fuse should blow out on an up-grade and the brake fail to hold the car, the motorman could quickly throw over this bridging switch, thereby closing the circuit and thus regain control of the car. That accidents of this character can happen is not a matter of pure conjecture. The writer has noted two such cases in his own experience; fortunately neither one resulted seriously. In the first case, when the car began to run down hill, the conductor realized that something had gone wrong and that the car had got beyond the control of the motorman. He had enough presence of mind to apply the brake, which fortunately acted from the rear end, although it had failed from the front. An inspection revealed the fact that one of the brake levers at the front end had become caught by a bolt projecting from the truck frame, and could not be moved. In the second case, the car was provided with a fuse box of a design suggested by the first experience, which contained a bridging switch. This fuse was located at one side of the controller and so arranged that the switch could be thrown in by a movement of the foot. As soon as the motorman found that the brake would not work he moved the fuse switch, thus closing the circuit around the gap, and then turned the controller handle to go ahead, which at once brought the car to a standstill and reversed the motion, sending it up hill instead of down. Although the passengers were jolted to some extent, no damage was done. In this case, if the fuse box had not been placed within reach of the motorman and if it had not been provided with a switch to bridge over the fuse gap, the car would have gone to the bottom of the hill, as the brake had become disarranged in such a manner that it could not have been operated from the rear end any better than from the front.

Many accidents have been recorded where cars, when running on grades, have got beyond the control of the motorman and have run to the bottom, and in some instances with serious results. If these cases were looked into it would doubtless be found that in many of them, the cause was due to the fuse blowing out and the brake failing to act. It must be evident, therefore, that, if not actually dangerous, it is at least not prudent to place the fuse where it cannot be reached by the motorman nor to make it so that the circuit cannot be closed around the gap in case of an emergency. The efficiency of the lightning arrester and the kicking coil, cannot be improved by changing their location, as shown in Fig. 1. As now located they will perform their functions as well as in any other position. The only objection to this arrangement is that several unnecessary single wires must be run in different directions under the car, on account of the scattering of the various parts. If the apparatus is concentrated in as few places as possible, there will be fewer wires outside of the main cables, and, as a result, the liability of getting out of order will be less. If all the switches, the fuse, the lightning arrester and the kicking coil were located within the controller casings, there would be no wiring required other than the main cables, and this would be a decided simplification, as may be seen by comparing Figs. 1 and 2. In the latter figure, it will be noticed that the trolley wire, instead of making almost a complete circuit of the roof of the car, goes directly to controller C^1, and all the wiring under the car floor consists of the two main cables and the ground wire. The latter can be dispensed with in most cases.

The arrangement shown in Fig. 2 could not be used with the controllers now in use, as there is no vacant space within them in which the several parts may be located; but there is no difficulty in the way of making the parts of the controller more compact, so as to provide the necessary space, and without increasing the external dimensions. This statement is not made on the mere assumption that everything is possible, for such which would serve the same purpose as the hood switch From this emergency switch it would pass to the fuse, and then to the lightning arrester and the kicking coil From the kicking coil, it would enter one of the main cables 1 and 2, and pass to the other controller, where it would connect with the emergency switch; then to the fuse, the lightning arrester and the kicking coil, and from here would run to the wire connected with the trolley terminals of the controller switches. In the foregoing arrangement the two sets of apparatus in the controllers would be placed in series. This would afford the best protection against lightning, for should the first arrester and kicking coil fail to divert the charge, the second one might be more successful. The fuse in this case would have to be so constructed that the one in the controller which was not in use could be bridged by the switch; otherwise this fuse might blow out instead of the one under the control of the motorman.

By placing the emergency switches, the fuses, the lighting arrester and the kicking coils in parallel, a length of wire could be saved, and it would not be necessary to arrange the fuses so that the one not in use could be short-circuited. This could be done by running the wire that connects the trolley terminals of the controllers from the entering terminals of the emergency switches. It would simplify matters somewhat, but the first method would undoubtedly be the best.

As already stated, the ground wire can, in most cases, be dispensed with, since there are but few trucks in which the frame is not grounded. Where this is the case, the ground wires from the controllers can be run to any convenient point on the truck, as shown by the broken lines *A* (Fig. 2), and the motor ground wire G^3 can be grounded on the motor itself. The ground wires G^1 and G^2 are really unnecessary, since connecting G^2 with the frame of the motor, as well as with *G*, would answer every purpose. They are shown in Fig. 2, as it was not desired to do anything that would look like an effort to make this figure appear simpler than it really is, and if these wires are necessary in the arrangement shown in Fig. 1, they should also be placed in Fig. 2; but their use is about equivalent to killing a mad dog twice to make sure that he is dead.

From all the foregoing we can see that while the motors have been greatly improved, little if any progress has been made in the way of simplifying the wiring and rendering the accessory apparatus more effective and convenient. We have pointed out that improvements in this line are possible, and, if called for, would in all probability be soon forthcoming.

American Railway Association.

The semi-annual meeting of this association was held in New York City, Oct. 7, with a good attendance. The new President, Major E. T. D. Myers, in his opening address said:

You will not at this meeting, so far as committee work is concerned, be called upon to consider any subject altogether new to the association.

The Committee on Train Rules has been engaged in the work of revision of the existing code and its adaptation to both single track lines and those of greater capacity, the need of which has been acknowledged. A decade ago that committee addressed itself to the formulation of a Standard Code, having in mind chiefly the operation of single track, and in due time accomplished it in a manner satisfactory to the association and very generally approved by those whose calling lies within its province. It appears that its present endeavor is not, as at the outset, so much to bring about reform or reconcile diverse practice or opinion. In this the committee has already and to a remarkable extent succeeded. The aim now is toward greater simplicity, conciseness and elasticity, as well as a closer adaptation to conditions some of which have more recently arisen.

Experience teaches the need of deliberation, not only in ascertaining the principle of every rule and definition, but in selecting the language which embodies that principle, and impels us to weigh our utterances not only clause by clause and paragraph by paragraph, but sentence by sentence and word by word. This was perhaps not sufficiently recognized by any of us at first. By some indeed the nice distinctions, which sometimes provoke wearisome debate, were not only regarded as pedantic, but rather condemned as bars to progress.

In a body like this such views could not endure. The next edition of the Standard Code (a thing it may be taken for granted, some distance in the future) should, after undergoing the committee's revision, and then passing the ordeal of discussion on this floor, be not easily impeached. Happily, we can well afford to wait. There are no defects in the existing code which to any serious extent mar its effectiveness. Its use is widespread; the dissenters from its creed are comparatively few. No member need hesitate for fear of impending alteration to adopt it in the present form.

The Committee on Car Service has submitted a report, to which your attention is invited. It is accompanied by an elaborate map portraying by varied color the extent to which the system of Car Service Rules of this association now prevails. A glance will satisfy you that the great preponderance of the members conduct their business under those rules.

The Committee on Safety Appliances having in conjunction with the Train Rules Committee to a great degree successfully performed the work of defining, prescribing and regulating the practice in block signalling, now enters a domain within which many questions of a difficult nature present themselves, sometimes involving mechanical detail; questions as to which there is room for radical difference of opinion, both as to principle and practice; a subject with which many members, if not the majority, are unfamiliar, which nevertheless presses upon us and in importance ranks with any within the field of your inquiry.

The circulars recently emitted by this committee sufficiently foreshadow the method of treatment. Their interrogatories will, it is hoped, be fully and scrupulously responded to.

The Committee on General Regulations for Employees submits for discussion at this meeting a report upon which it has bestowed much labor. The matter with which it is dealing is by no means simple. It demands in a peculiar degree careful and considerate treatment,

It is not always easy to establish the precise line between provisional rules and general regulations. It is not less difficult to define the boundary between the departments affected by a regulation. The nomenclature, even, is by no means free from ambiguity. It behooves the Association to consider this report with great care, and to scrupulously observe the request of the committee that it shall have abundant opportunity for revision when revision may be esteemed necessary.

Finally, on behalf of the committees, your attention, your aid, your unbiased judgment and your outspoken criticism in all matters which come before you are invoked. Let me urge you not to hesitate to make inquiries, challenge conclusions, or utter freely what may occur to you in the course of the proceedings upon which we are about to enter, and when the Association has, after its cautious and deliberate method, reached a conclusion, I cannot too earnestly impress upon its members the importance of conforming to it.

The date fixed for the Fall change of time is Nov. 15.

The Committee on Standard Wheel and Track Gages, C. W. Buchholz, Chairman, reported in favor of a track gage of 4 ft. 8½ in. The report was accepted and the question of adoption ordered submitted to the members of the association for a letter ballot, each road to have a number of votes corresponding to the mileage of its line.

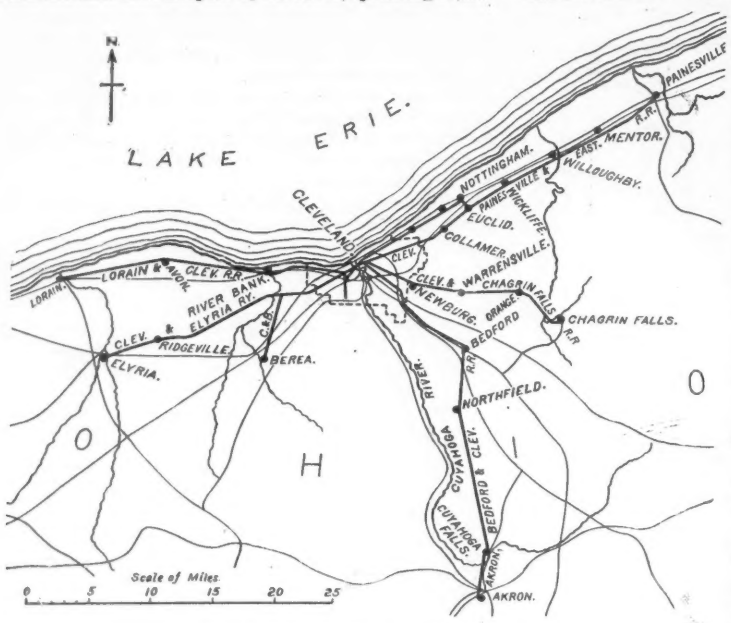
The Committee on Safety Appliances, C. H. Platt, Chairman, reported that it had begun an investigation of the subject of interlocking of switches and signals, but that it had not made sufficient progress to have anything to report. Major Myers, now President of the Association, was formerly Chairman of the Committee on Safety Appliances. His retirement from that position is followed by two changes. Mr. C. H. Platt becomes Chairman and Mr. C. H. Schaff (C., C., C. & St. L.) takes the place of Major Myers. Mr. George B. Leighton, President of the Los Angeles Terminal, takes the place of Mr. Rawn.

The Committee on Train Rules made a report, the substance of which is indicated by the clauses on that subject in the President's address. This committee has compiled a list showing that the Standard Code of train rules has now been adopted by 133 roads, operating 97,221 miles. Twenty-five other roads, operating 18,903 miles, intend to adopt it.

The Committee on Car Service, J. B. Hutchinson, Chairman, has corresponded with the various traffic associations concerning the excess in weight over the marked capacity that should be allowed to be loaded in freight cars, but no satisfactory response has been received except from the Central Freight Association, which has adopted the rule of the American Railway Association, that 10 per cent. in excess of the marked capacity should be the maximum. The Southwestern and the Chicago & St. Louis associations decline to take action in the matter, as it is held to belong to the operating department.

The committee has considered the "large-car problem," but has not as yet formulated any recommendation. The question whether, in the case of a detoured train, the mileage of cars should be paid by the road over which the train is run is unanimously decided by the committee in the negative. The committee has prepared for the members a map showing the railroads and stations at which the association's demurrage regulations were in force on Aug. 1.

The number of roads in the American Railway Association is now 242, operating 154,000 miles. The next meeting will be held at Richmond, Va., April 7, 1897.



New Electric Roads Near Cleveland.

Electric Roads Near Cleveland.

Those who have watched the progress of electric railroads that are being built to compete with the steam roads in different sections of the country, have doubtless become more or less familiar with the new lines in the vicinity of Cleveland. We have frequently referred to these among our construction notes and occasionally by separate articles. All of the projected roads have not been completed, while the others are in active operation. The six electric roads, shown on the accompanying map, have one terminus in Cleveland and each will parallel one or more of the steam roads running into Cleveland. To just what extent these steam roads will be affected by the electric roads, cannot now be determined, but the passenger traffic will doubtless be injured. The electric lines have possibilities as freight carriers, the extent of which is yet to be shown. In other parts of the country the steam roads have suffered by the adoption of electric lines between important stations. This is especially true in Connecticut.

About a year ago the Akron, Bedford & Cleveland Railroad Co. completed the 30 miles of new road which it had been building. Akron has a population of about 30,000, and the new line runs through a thickly settled district. The round-trip rate from Akron to Cleveland is one dollar, single trip 60 cents. The steam road charges $1.10 for a single trip and $1.90 for the round trip. The track is ballasted with slag and gravel, and is built according to the specifications for steam roads. The feed wire has a capacity of 300,000 circular mills and the trolley wire is the B. & S. No. 0000. One of the power-houses is located at Bedford, six miles from Cleveland, and the other at Cuyahoga Falls, on the Cuyahoga River. The cars have been equipped with the Hunt airbrake, but will still use the old type of handbrake as an emergency brake. They are now being equipped with electric heaters.

The Cleveland & Elyria Electric Railroad Co. was chartered October, 1894, and began operations last December. The general plan of equipment is the same as on the A., B. & C. line just described. The fare for the round trip from Cleveland to Elyria is 75 cents.

The Cleveland, Painesville & Eastern Railroad parallels the Lake Shore & Michigan Southern, and extending from Euclid avenue, Cleveland, to Painesville. Beside the features mentioned in our description Aug. 21, we might add that the cars are being equipped with electric brakes made by the General Electric Co. The ties for this road are of white oak, 5 in. × 8 in. × 7 ft., which rest on broken stone ballasted with cinders.

The Cleveland & Chagrin Falls Electric Railroad Company was chartered in December, 1895, to build and operate an electric railroad from the eastern limits of Cleveland to the town of Chagrin Falls, a distance of 14 miles. The officers are: Vincent A. Taylor, President; Jay E. Latimer, Secretary; R. L. Palmer, Superintendent; C. G. Barkwill, Treasurer; James Ritchie, Chief Engineer. The contract for construction and equipment complete was let to the Albion Construction Company, of Chicago. The grading, masonry and a portion of the bridge work is completed on 12 miles of the line, the track laid for about 1½ miles and the material for the track is ready for 2½ miles more.

The line connects at the Cleveland city limits with the tracks of the Cleveland City Railway Co., over which the company will be able to make connections to all parts of the city. The line extends through Newburg, Warrensville and Orange to Chagrin Falls, crossing the Chagrin River over a new high bridge 365 ft. long, built by the King Bridge Co., of Cleveland. For eight miles the line is on the county roads and the remaining four miles is through a private right of way. The power-house is to be built of brick with slate roof, and located about in the middle of the line. Engines will be high pressure, direct connected to generators, and will be built by Russel Machine Co., of Massillon. The Walker Manufacturing Co. will furnish the generators and car motors. The cars, which are being made by the Pullman Company, will have double trucks, will be 40 ft. long over all and vestibuled at each end. They will be finished in oak on the inside, and the seats will be so arranged that there will be a center isle. Two 50-H. P. motors will be placed on each car. Rails are 60-lb. T, except in Chagrin Falls where they are 70-lbs. girder. Maximum gradient will be four per cent.

There will be one trestle bridge 250 ft. long and 40 ft. high and 12 small bridges, besides the Chagrin River Bridge already mentioned. The company will construct a storage reservoir near its power-house for water supply. The company expects to have the road in operation in about 60 days.

The Lorain & Cleveland Railroad Co. received a franchise in May, 1896, to build a road between Lorain and Cleveland. The total length of the line will be 19 miles, extending from the west end of the Detroit street line of the Cleveland City road, at Rocky River, through Rockport, Dover, Avon and Sheffield to Lorain. The entire line is through private property. The road is being built to steam railroad specifications as to superstructure; 70-lb. T rails will be used; the grades will be light and the curvatures exceedingly small. One of the power-houses will be started this fall. The contracts for grading, masonry and trestlework have been let to Wm. McReynolds, of Cleveland, and the company expects to have the line in operation by June 1, 1897.

The officers are: President, B. Mahler; Vice-President, E. G. Tillotson; Treasurer, E. W. Moore; Secretary, Jas. B. Hoge; Asst. Secretary, F. W. Cocu; Engineer, E. H. Arnold.

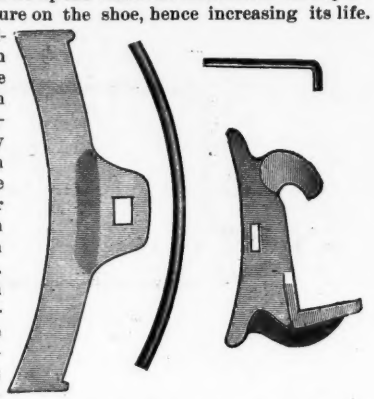
The total mileage of the electric roads about Cleveland, when all are completed, will be nearly 125, divided as follows:

Akron, Bedford & Cleveland	30
Lorain & Cleveland	19
Cleveland, Painesville & Eastern	30
Cleveland & Elyria	20
Cleveland & Chagrin Falls	14
Cleveland & Berea	11

The Kinzer Brakeshoe.

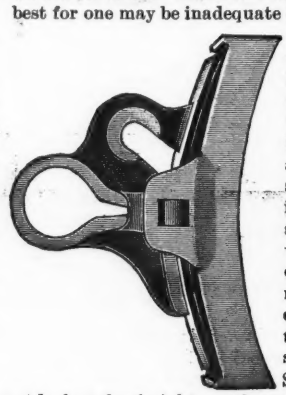
The Kinzer & Jones Manufacturing Company, of Pittsburgh, Pa., is making a composition brakeshoe that has shown some very excellent results during recent tests. This shoe consists of a cast-iron shell filled with composition material. The composition consists of cast-iron borings, carbon in the form of charcoal, asbestos, resin, black lead and linseed oil. These materials are put in the shells under heavy pressure. The shoes are then baked in a furnace at a high temperature.

With this shoe is used the Kinzer brakehead and connections, which provide for a steel spring back of the shoes, so that the braking pressure is transmitted by means of the spring to the shoe and forms a cushion. This spring takes up the vibration and chatter and equalizes the pressure on the shoe, hence increasing its life.



Where ordinary cast-iron shoes have been used with the spring connection, they have been found to give twice the wear obtained with the usual form of connection.

The question of the best material to be used for brakeshoes has not yet been settled. In each case, the *ultimate cost* must be the governing factor in the selection of brakeshoes. But such differences exist between the conditions of service on various roads that a metal shoe which is the best for one may be inadequate for the needs of another.



For instance, on street railroads the cars are light and stops must be made at frequent intervals, while it is of the highest importance that a fairly high schedule speed be maintained. It is evident that a brakeshoe will be selected which will permit of quick stopping without noise, and the wearing qualities will be regarded to a large extent as of secondary importance. Such a brakeshoe would not be best for freight service where short, quick stops are not essential, but for such service a brakeshoe which will not injure the wheel and which will wear long is needed.

The Committee of the Master Car Builders' Association has very wisely refrained from recommending any particular metal, as such a recommendation would only be of value when accompanied by a statement of the conditions and needs of the particular service. The first report of this association gives sufficient data to enable each road to determine for itself whether it is obtaining the best braking service possible.

It has long been acknowledged that a single brakeshoe which would combine all the essential features and give fairly good results under all conditions of service would be a means of great saving to railroad companies. Such a shoe should embody the following characteristics: Low first cost, must not cut or injure the wheel, high and uniform co-efficient of friction, must not grip the wheel at low speed near the end of the stop, must wear slowly, must not heat excessively during application, must make smooth stop without noise or "screeching."

A study of the results of the brakeshoe tests made by the Master Car Builders' Association shows that all *metals* tested have one or more objectionable features under certain conditions. It therefore follows that the only material which will answer the requirements of a perfect brakeshoe must consist of a combination of metals or a composition material. This has been brought out in a striking manner by the results of the Master Car Builders' tests with the Kinzer brakeshoe, as published in the final report.

An examination of this report shows that the highest co-efficient of friction was obtained, under all conditions, when using the Kinzer shoe. This was the only shoe tested which gave a smooth stop, without jar and chatter, this being true both when tested with and without the spring at the back. The diagrams in this instance were nearly a straight line, with no tendency to run up near the end of the stop, signifying a nearly uniform pull on the brake hanger throughout the entire stop.

In regard to the heating effect of the Kinzer shoe the report says: "It was observed that all shoes having cast iron for the rubbing surface either in whole or in part became heated to a higher degree during a test than did the shoes of wrought iron and steel. In the case of the Kinzer shoe practically no heat was absorbed by the composition filling." In regard to the effect of this shoe on the chilled test wheel, it says: "This shoe has no tendency to roughen the wheel and imparts to it a high polish."

The Master Car Builders' brakeshoe tests do not show the relative wearing qualities of the various shoes. To investigate this point regarding the Kinzer shoes, Mr. S. P. Bush, Superintendent of Motive Power of the Pennsylvania Lines west of Pittsburgh and Chairman of the Committee on Laboratory Tests of Brakeshoes, put a number of these shoes in service on his road with the *standard* cast-iron shoes. Both were used under the same cars so that no practical difference in condition prevailed. We have received the following letter from Mr. Bush which gives the results of these tests: "I find, as a result of our test of the Kinzer shoe, that 56 days' service of the standard shoe and the Kinzer shoe give the following results:

"Standard shoe, amount worn off per shoe, 7 lbs.

"Kinzer shoe, amount worn off per shoe, 1 lb.

"It should be borne in mind that on account of the composition of the Kinzer shoe, the specific gravity is therefore, not as great as cast iron. Comparisons of the wear, by weight alone, is not fair. It is safe to say, however, that the Kinzer shos will give the same service for one third of the wear."

The weight of the standard cast-iron shoe is 20 lbs., and that of the Kinzer shoe 15 lbs. A number of the largest roads in the country are now making trials with the Kinzer shoes and several have adopted them as their standard. This company, while new in the brake-shoe business, has the advantage of being an old and established firm in other lines and in possession of a large plant, well adapted to the manufacture of brake-shoes.

Cooke Consolidation Locomotive for the Baltimore & Ohio.

The accompanying illustrations show one of 10 new consolidation locomotives built for the Baltimore & Ohio Railroad by the Cooke Locomotive & Machine Co., Paterson, N. J. These locomotives are Nos. 1600 to 1609 inclusive; their total weight in working order is 166,000 lbs., with 152,000 lbs. on the drivers, and 14,000 lbs. on the truck. The weight of the tenders loaded is about 80,000 lbs. Soft coal will be burned, and the firebox is provided with a brick arch; the grate is of the rocking bar type. The engines are all provided with Westinghouse-American driver brakes.

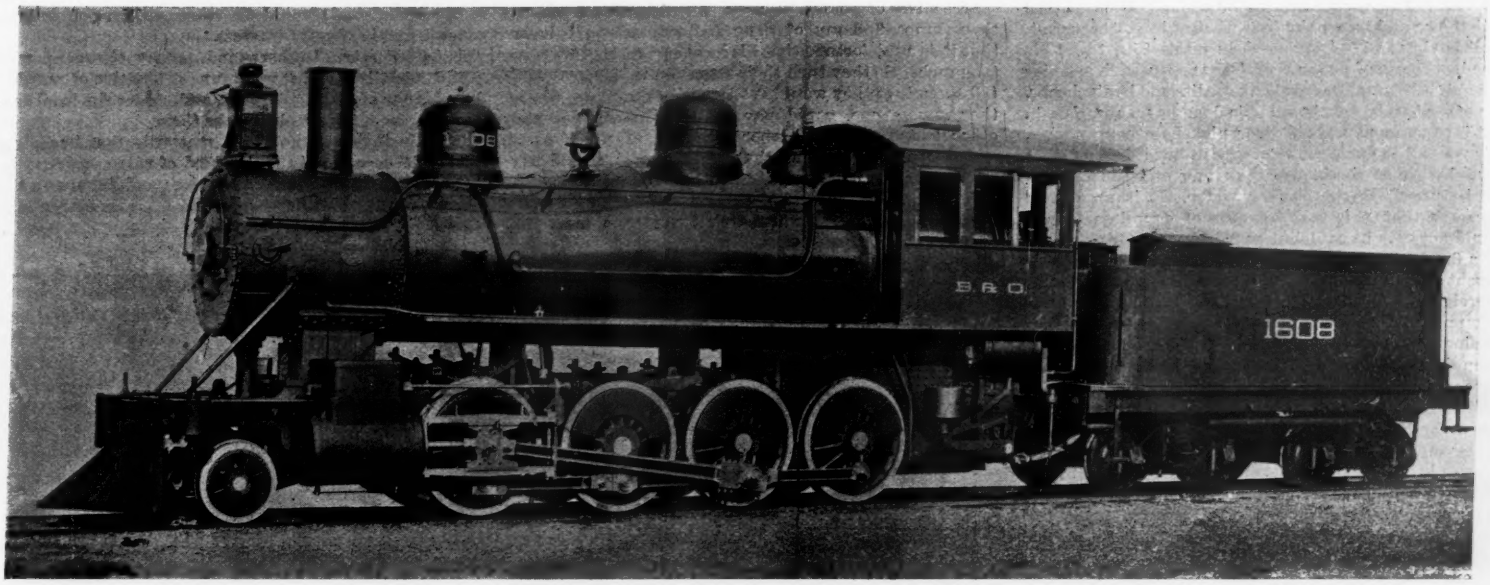
A table follows, giving the general dimensions and description of the locomotive and tender.

General Dimensions—Locomotive.

Type	Consolidation
Simple or compound	Simple
Total wheel base	23 ft. 2 in.
Rigid wheel base	15 ft.
Total wheel base of engine and tender	51 ft. 7 in.
Total length of engine and tender over all	61 ft. 3 in.
Diameter of cylinders	22 in.
Stroke of piston	28 in.
Diameter of piston rods	4 in.
Size of steam ports	20 in. × 1⅝ in.
Size of exhaust ports	20 in. × 3¼ in.
Greatest travel of slide valves	6 in.
Outside lap of slide valves	1¼ in.
Lead of slide valves in full stroke	1/16 in.
Diameter of driving wheels, outside	64 in.
Kind of truck wheels,	30 in. steel tired, wrought-iron spoke center
Diameter of truck wheels	30 in.
Size of driving-axle journals	8½ in. × 10 11/16 in.
Size of truck-axle journals	5 in. × 8¾ in.
Size of main crank pin journals: main road	6½ in. × 6 in.
Size of main crank pin journals: parallel rod	6½ in. × 5¾ in.
Kind of boiler	Wagon top
Diameter of boiler at smallest ring	64 in.
Material of boiler	Park Bros.' steel
Thickness of plates in boiler barrel	7/16 in. and 5/8 in.
Thickness of plates in firebox shell	5/8 in.
Thickness of plates in sides, back end and crown of firebox,	3/8 in. and 7/16 in.
Thickness of plates in front and back tube sheets	½ in.
Kind of horizontal seams	Butt with double welt
Kind of circumferential seams	Double-riveted
Material of tubes	Iron
Number of tubes	248
Outside diameter of tubes	2¼ in.
Length of tubes over tube sheets	14 ft. 9 in.
Inside length of firebox	9 ft. 7 in.
Inside width of firebox	3 ft. 5 in.
Depth of firebox from crownsheet to bottom of mud ring: front	69 7/16 in.
Depth of firebox from crownsheet to bottom of mud ring: back	67 5/16 in.
Water spaces, sides and back	3 in.
Water spaces, front	4 in.
Crownplate stayed with	Crownbars
Diameter of dome, inside	30 in.
Height of dome	24 in.
Steam pressure	180 lbs.
Kind of grate	Rocking
Grate surface	37.75 sq. ft.
Heating surface of firebox	182.5 sq. ft.
Heating surface of tubes	2,155 sq. ft.
Total heating surface	2337.5 sq. ft.
Height from top of rail to top of smokestack	14 ft. 7 in.
Tires	Standard Steel Co.'s,
Guides and cross-heads,	guides steel, cross-heads steel, Alligator style
Connecting rods	Channeled bodies
Brakes	Westinghouse-American driver brakes
Lubricators	Nathan triple
Injectors	Monitor No. 10
Valves	Richardson balanced
Gages	8½-in. Cros by
Springs	Pickering
Headlight	Kelly 18 in. with B. & O. frame for numbers
Special devices	Coale 3-in. muffled safety valves

Tender.

Wheels	33-in. chilled
Axles	Steel
Size of axle journals	4¼ in. × 8 in.
Water capacity of tank	4,000 gals.
Frames, wood or metal	Wood
Brakebeams	National hollow
Brake-heads and brake-shoes	Christie



Consolidation Locomotive for the Baltimore & Ohio.

Mr. Harvey Middleton, *General Superintendent Motive Power.* *Built by the* Cooke Locomotive & Machine Company, *Paterson, N. J.*

A Leap in the Dark—Being a Letter on the Silver Question.

BY THOMAS C. CLARKE, *President American Society of Civil Engineers.*

The writer of these few pages is not a banker, nor a "Wall Street Gold Bug," but an old bridge builder and mechanic, known personally and by reputation to many railroad men. Some of them have asked him for his views on the silver question, and here they are:

I shall leave to other hands the task of refuting the fallacious arguments of the silver men. I shall point out, as briefly as possible, the fatal consequences which always have followed, and will now inevitably follow, any tampering with the standard of value.

The silver men demand free and unlimited coinage of silver dollars—that is, that every owner of the metal silver shall be able to bring it to our mints and have it coined into dollars, as the government now do—at the rate of 16 oz. of silver equal to 1 oz. of gold.

When it is asked what will be the value of these unlimited dollars we find that the silver men are divided into two camps and hold two entirely opposite views.

The silver miners and the bi-metallic professors and Mr. Bryan when he is in New York say that free coinage will raise the value of all silver dollars to the value of a gold dollar.

The Popalists and Mr. Bryan when in the West say that it will cut down the value of a silver dollar to that of the metal of which it is made, or 53 cents

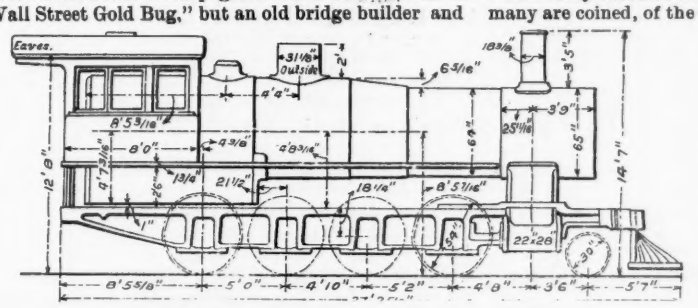
All experience shows that the Populists are right. Our attempts to keep up the price of silver by the enormous purchases under the Bland and Sherman Acts of 359 millions of ounces caused a slight rise for a short time, and then silver went down until this silver and silver bars, for which the government paid 463 millions of dollars, is worth now only 248 millions, showing a loss of 215 millions; which is enough to have built the Nicaragua Canal, and to have improved the waterways from the great lakes to the ocean.

Moreover, the use of silver by some 1,000 millions of people in China, Japan, India, Mexico and South America has not been able to keep it from falling from $1.29 to 69 cents per ounce.

The Populists are right and they see the facts more clearly than the other branch of the silver men. The Populists say that cheaper dollars and more of them is just what we want. People could then pay off their debts for half their original cost, and the price of every thing the farmers raise would be doubled.

Some say that if wages were only one half what they now are, we could compete with the cheap labor of foreign countries. We should then need no tariff on imports, and a graduated income tax would give sufficient revenue to the government. They say openly that if free coinage would make the value of an unlimited amount of silver dollars equal to gold ones they would have none of it, for the present situation would not be improved.

I respect the *courage* of the Populists. They have done us good by boldly showing their hand, and telling us to our faces that if they can get possession of the government they will take away from those that have and give it to those who have not. They may be robbers, but they are not sneak thieves. They scorn to tell us that they will make all our dollars, no matter how many are coined, of the same value as gold. They will cut them in halves and we can take half instead of the whole and be thankful to get that.



Consolidation Locomotive for the Baltimore & Ohio.

Whether the new dollars will be worth 53 cents or 100 cents each, one thing is sure—nobody can get a dollar in this world without earning it by work, or by having it given to him, or by stealing it. The new dollars will belong in the first place to the owners of the metal silver who get it coined into dollars. There is only one way in which the people at large can get hold of them, and that is by a great increase in all kinds of business, which now is dull.

We will attempt to show that so far from this being so, free coinage will cause the most disastrous panic this country has ever seen, by taking away from us a fixed standard of value and giving us an uncertain one that fluctuates with the market value of silver. It will destroy *confidence*, upon which all business depends. In order to make this clear we will describe how business is carried on in all progressive countries.

One of the most beneficent laws which God has ever given to man is the *law of machinery*, which binds together, in a bond that cannot be broken, high wages, low prices of all products and a fixed standard of value. By the use of machinery one man can produce, or can move by railroad or steamer, many times as much of anything as he can without machinery and the inventions that make machinery powerful. At the same time in order to use machinery *efficiently* the employer must pay high wages in order to get skilled labor.

The greater the skill of the workman the greater the profit, and this enables the employer to pay high wages. This not only raises the wages of those actually employed in tending machinery, but it also raises the wages of all classes of workers, for as business is increased, the general prosperity of the country is increased, and more work of all kinds goes on.

Production becomes so great, and business becomes so much increased, that it becomes impossible to do business by the use of coins alone, as was done in old times. A new kind of machinery is invented, that of *credit*. It has been found by careful examination, and is as true as that two and two make four, that at least 90 per cent. of all buying and selling (and in cities 95 per cent.) is done by the use of *paper promises to pay*, such as notes of hand, bills of exchange, bank credits and bank checks. The other 10 per cent. in value is done by means of cash, that is paper money, gold, silver, nickel and copper coins. This we call the machinery of credit, but it can no more be used without confidence than any other machinery can be used without coal or water. It is absolutely necessary that this vast amount of promises to pay should not only be paid, but be paid in something which has a fixed standard of value, and that, by the common consent of all progressive nations, is a gold dollar, sovereign, napoleon or 20-mark piece.

You may have heard of or seen the object lesson that the clown used to give at the circus. He placed half a dozen of the circus men in a line and said to one: "Bill, I owe you a dollar," and handed it to him. The next man to Bill says: "Pay me that dollar you owe me." Bill does so, and the one who gets it pays it to the next man, and so on until the last man pays the clown the dollar he owed him. At the end every one was free of debt and the clown had his dollar. Suppose it had been a paper dollar and one of the men refused to take it until he had gone to the bank and found that he could get a gold dollar for it, if he so wished. Then he would take it fast enough.

The clown illustrated by his little scheme that nine-tenths of our business is only the settlement of balances and that the settlement must be in something of undoubted value. He was the unconscious inventor of the clearing house system, by which fifty-one thousand millions of dollars of business transactions were settled last year in the United States with only six per cent. of cash.

All we want is to be sure that our paper dollar or our bank check can be changed into a coin worth a dollar really. Then all is well. But if our dollar is worth 53 cents one day and a week after but 49, as we have just seen has happened to silver, confusion will take place.

Confidence, which has been well said to be a plant of slow growth, being once established by a fixed standard of value, all business goes on. Experts estimate the total of all buying and selling in this country yearly is about one hundred thousand million dollars. The amount of money actually in circulation shows how small a part cash plays, and of the cash used how little is silver.

The Treasury Report of last July shows there are $1,041,421,000 of paper dollars, $52,175,998 of silver dollars and $59,999,805 of halves, quarters and dimes; all the other 378 million silver dollars lie idle in the Treasury. Fifty-two million is all the people will use. The reason they do not use it is because the other kind of money, which we have called credit money, is more convenient. Money is nothing but counters, like the chips used in playing games. You can't win or lose by increasing the number of chips. Yet to gain a fancied benefit, and increase the demand for silver, the silver men would destroy the fixed standard of value upon which all our vast business depends. They would reduce us to the level of the silver countries, Mexico, China, Japan and the South American Republics.

We call your attention now to a very important fact, which illustrates clearly the working of the great "law of machinery" which we have described.

The standard of value of these countries is silver, which changes in value daily. Hence they are unable to make much use of the machinery of credit, checks, notes, etc. Hence they use very little machinery; hand labor does everything, and their business is limited to raising and selling agricultural products. Wages are very low. Prices of all manufactured articles are very high. Laboring people live on rice and beans. The only thing that can be said in their favor is that they are free from financial panics, which they do not have for the same reason that negroes do not suffer from insomnia.

The effect of unlimited coinage of silver dollars would be that the prices of every thing you eat, drink or wear would at once double, as the storekeepers and manufacturers could only protect themselves by marking up prices. Wages, however, would not double for (as Mr. Bryan himself admits) a tremendous panic would take place. Manufactories would be closed, wages cut down, and men discharged. As the interest on railroad mortgages must be paid in gold, and as the money could only come from net earnings in 53-cent dollars, there would be a deficiency which would have to be partly made up by discharging railroad men and cutting down the wages of those who remained.

As if this were not enough, when you went to the store to buy food for the home, you would find that the prices of tea, coffee, sugar, clothing, etc., had been doubled in price.

But, suppose after a while things settled down. You would naturally ask for an increase of wages. We all know what a long and hard fight it is now to get wages raised. But when they are raised, we know exactly what we get. But if our dollar is of changeable value, and we struck for a quarter of a dollar daily increase of wages, by the time we got it we might find that the dollar had lost nearly all of the quarter in value that we thought we had gained.

Silver dollars have fallen from 53 to 49 cents during the past week, in spite of Mr. Bryan.

During the hard times you would have to draw out the money you had saved and invested in workmen's benevolent societies, life insurance companies, and savings banks. Every dollar would have become worth only 53 cents and would have lost half of its purchasing power.

Free silver orators fight very shy of workingmen, as they cannot find any of them fool enough to believe that it is a misfortune that his hard-earned dollar buys too much. So they turn their attention to farmers and tell them that they would get two silver dollars where they now get one, could pay off their mortgages and other debts and hire all labor with half as much as it now costs. This means that workingmen would pay half the farmers' debts, and the other half would be repudiated. The success of this pretty scheme depends upon the belief that farmers are all rogues, a most impudent libel on one of the honestest set of men there are in the world.

Telling farmers that they could get two dollars for one means that prices would remain the same as they now are in gold, which would be double in 53-cent silver dollars. This can easily be shown to be false: Our farmers sell two-thirds of their wheat, nine-tenths of their corn, half of the products of the hog, a third of their cotton and tobacco, and nearly all their wool, fruit, hay and dairy and hen products in our own country. A fall of price below the average is due to a poor home market. Short crops in Europe raise prices here *temporarily*, but the only *steady* factor is the home market.

The present dull home market is due to the stoppage of business, coming from the agitation about free silver and meddling with the tariff. This has put half of the people of the United States on short commons. Demand being less than the supply, prices have fallen, and neither silver nor gold has had anything to do with it.

The panic predicted by Mr. Bryan would cut down the consumption of the people of this country much more than it now is, and prices of all agricultural products would fall still more. The home market would be ruined. Foreign buyers would then take advantage of low prices and turn every one of their gold dollars into two silver dollars, and force the farmer to take them as legal tender. The farmer, cut off from the home market, could not raise his prices and he would have to take what he could get, or starve.

I have no fear that our farmers will starve. They are too honest to vote for repudiation.

The elections of 1868 and 1872 turned on the question of paying our bonds in specie or in depreciated paper, and all the Northern agricultural States gave large majorities to the Republican ticket, and they will do so now. The Attorney-General of the United States, in language none too strong, has pointed out that the Populist platform would take from the President of the whole country the power to put down insurrection in any particular State. Our Northern farmers put down this heresy with their bayonets once, and they will now put it down again with their ballots.

Who would be the gainers by the misfortunes we have described?

First—All rogues who had borrowed good dollars and were by law enabled to pay back dollars of half the value in settlement of their debts.

Second—Owners of silver mines. These people ask us "What good would it do us to pay our silver coined into dollars, if they were only to be worth 53 cents?" We reply—"You would pay them to your miners and not raise their wages. You would rush in and get as much silver coined into dollars as possible, and then when we had recovered from our temporary madness, and gone back to a gold standard, each dollar would be worth 100 cents." On one year's silver product of this country the profit would be thirty millions of dollars, after deducting loss of interest.

Third—Foreign bankers and money changers, who could coin silver and store it up, or buy two of our dollars for one of their gold ones, and, under the legal tender law, force the people to take them.

The conclusion of the whole matter is, that free silver means debasement of the standard of value; robbery by one class; beggary to everyone else; and involving the whole country in the shame and disgrace of repudiation.

New York Abutments of the Niagara Railroad Arch Bridge.

The Populist orators try very hard to excite farmers against the "money power." What is the money power? It is not the Vanderbilts and the Rockefellers who furnish the vast capital of our country. It is yourselves. The money in savings banks, insurance companies, workingmen's benevolent associations, etc., is the property of the vast army of working men, women and children. It amounts to over five thousand millions of dollars, and is owned in very small sums, by people in moderate circumstances. This money is lent by bankers and financial men (who are your agents) to merchants, manufacturers and others and moves the wheels of business which gives us all employment.

The Populists boldly say that the very fact that we have been able to save and lay up this great sum of money shows that we have been paid double what we ought to have got. It shows also, they say, that people who have lent on mortgages or have bought railroad or government bonds, have been getting twice as much interest as they ought to have done and that it is only right to pay them back in silver dollars of half their value.

You are the "money power," and you it is that the Populists attack and they say so.

The choice is in your own hands. Either preserve what we have—a fixed standard of value, the gold dollar good all over the world and all our paper and silver redeemed in it; active business, high wages and low prices for what you buy, or—

Go in for free coinage of silver, a shifting standard of value, dull business, low wages and high prices like all silver countries.

This is the "leap in the dark" into a gulf whose depths we have tried to illumine by the lamp of experience.

When November comes we shall have to decide for ourselves for whom we shall vote.

Both McKinley and Palmer stand upon honest platforms, but Palmer cannot be elected, and every vote for him counts only one against Bryan, while a vote for McKinley counts two.

Republicans and sound-money Democrats may safely unite in electing sound money men to Congress and the State Legislatures, but McKinley's majority should be not only large, but overwhelming. Thus will the American people show that they are in favor of a fixed money standard, with its revival of busines—that they detest repudiation, and will maintain law and order in the land.

OCTOBER 10, 1896.

Automatic Couplers in Service.

The Statistician of the Interstate Commerce Commission, Prof. H. C. Adams, reports from year to year the number of cars and locomotives oquipped with automatic couplers, and compiles a table giving the numbers of each make or pattern in use. The gross figures for 1895 we printed last week in an editorial review of the statistical report. Below we give the tables considerably condensed, showing the number in service for three years, by names of makers. The table contained in the report of the Statistician gives figures for seven years, but we nave omitted all columns but those for the last three years. The Statistician's table also gives a great many names of couplers, of which only very small numbers are in use. Those we have collected under the one item of "miscellaneous." Most of those thus summarized have only two or three, or possibly two or three dozen couplers in use.

The quantities given in this table include not only cars but locomotives. From the summaries we learn that the cars equipped amounted to 402,394 and the locomotives to 6,462. Of course these figures should be doubled for all the cars and for a good many of the locomotives, to get the number of couplers in use, the figures printed being, as we have said, the number of cars and of locomotives.

The year 1895 closed for the commission's purposes on June 30. To-day, therefore, the numbers here printed should be increased by all the output of more than 15 months. The increase in the number of cars equipped from 1894 to 1895 was about 50,000, and the increase in the number of locomotives equipped was 1,329. We may suppose, therefore, that there are at least 460,000 cars and locomotives now equipped out of a total of about 1,306,000.

For the purposes of the makers of couplers, however, the most interesting figures are with regard to freight cars alone. The Statistician reports 1,196,000 cars in freight service on June 30, 1895, and 41,330 in company's service. He reports at the same date 367,000 cars in freight service equipped with automatic couplers and 3,438 in company's service. There were also at that date 33,112 cars in passenger service, of which 31,971 were equipped with automatic couplers. It is safe enough to assume that there are 800,000 cars still left in the United States to be equipped, and of these all that are liable to be engaged in interstate commerce must be provided with automatic couplers before Jan. 1, 1898. But very much the largest number of freight cars run across state lines; that is, become interstate cars, and it is evident enough that if the law is to be complied with there are busy times ahead with coupler makers.

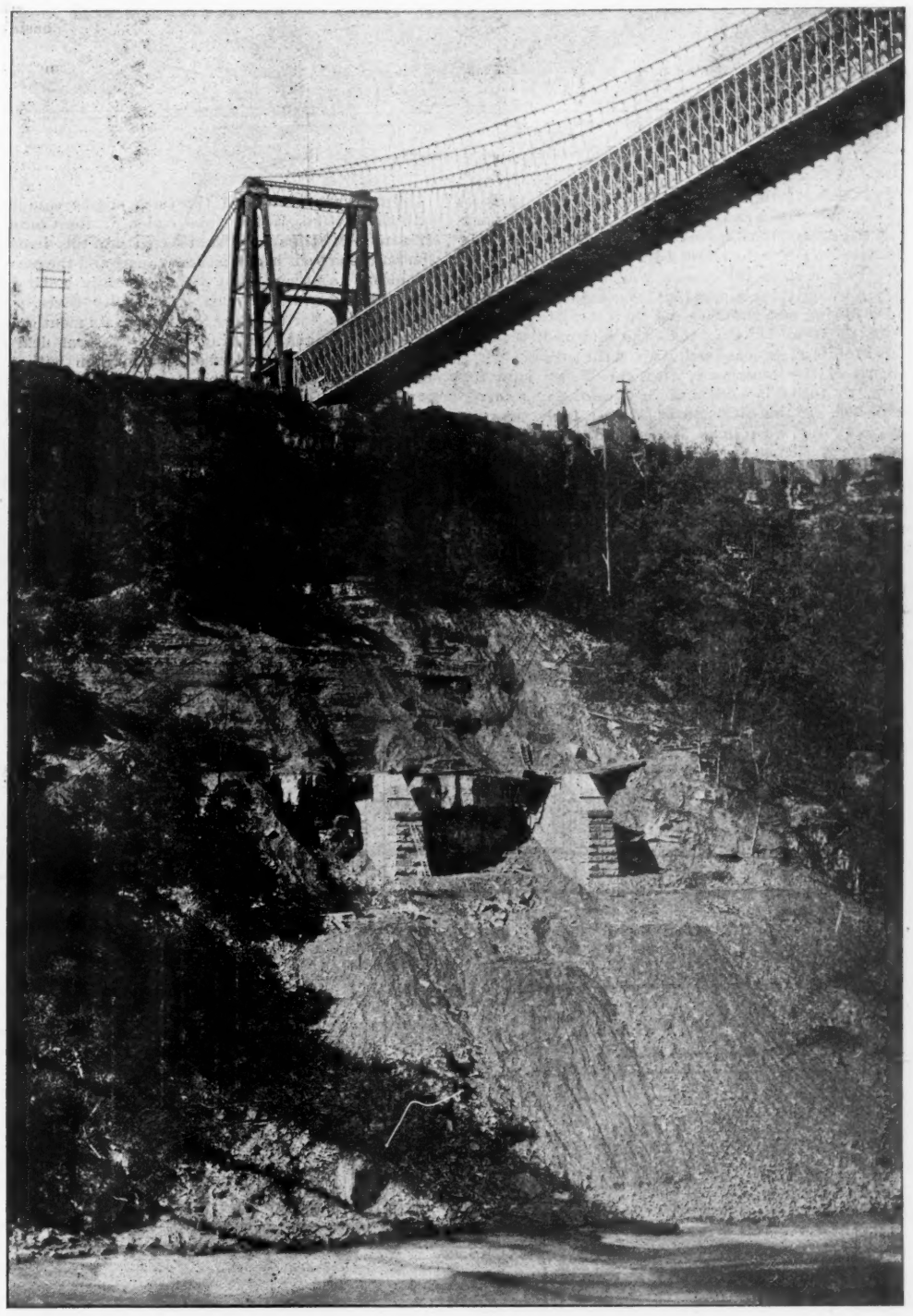
EQUIPMENT FITTED WITH AUTOMATIC COUPLER FOR THE YEARS ENDING JUNE 30.

	1895.	1894.	1893.
Ajax	109	.....	.....
American	2,035	368	287
Ames	1	371	372
Blackstone	144	144	144
Blocker	1,385	1,385	1,385
Buckeye	14,938	10,649	7,489
California	1,980	145	88
Chicago	22.964	15,440	13,07
Columbia	271	.....	.....
Cowell	117	156	149
Dowling	4,908	7,068	6,854
Drexel	1,039	809	456
Elliott	186	123	96
Eureka	400	365	4
Fox	144	132	110
Gould	105,725	77,278	59,774
Hinson	6,636	7,864	7,024
Huselton	720	722	2,647
Janney	143,726	117,781	102,056
Janney-Buhoup	162	108	109
Janney-Miller	107	153	471
Johnson	506	506	1,185
Louisville & Nashville	70	.....	.....
M. C. B	17,591	40,078	40,814
Marks	798	1,569	2,245
Mather	1,570	1,500	1,400
Miller	17,123	17,770	17,837
Miller-Buhoup	84	69	.....
Missouri Pacific	1,036	.....	.....
New York, New Haven & Hartford	100	.....	.....
Pooley	2,505	1,876	222
Sams	69	.....	.....
St. Louis	786	699	875
Safford	8,642	9,798	12,684
Shickle, Howard & Harrison	57	.....	.....
Smillie	7,606	7,358	5,268
Standard	5,947	3,234	1,736
Thurmond	5,549	3,821	3,432
Tower	2,873	45	.....
Trojan	17,646	12,793	7,964
United States	128	2	2
Van Doraton	7,703	12,572	14,210
Williams	2,231	2,155	1,810
Unclassified	143	166	6,074
Miscellaneous	425	559	1,311
Total	408,856	357,621	322,238

Abutments of the New Niagara Railroad Bridge.

Last April we published an account, with extensive illustrations, of the new steel arch bridge to be built across the Niagara gorge to replace the present railroad suspension bridge. The span of this arch is 550 ft. and its rise 114 ft. The foundation is extremely simple, notwithstanding the great weight of the structure, which will carry two steam railroad tracks besides an electric railroad, a carriageway and footwalks. The arch is hinged at the skewbacks, each truss having a batter of one horizontal to 10 vertical. The distance between centers of skewbacks is 56 ft. 7¾ in. The bed-plates rest on masonry founded on the rock. The total quantities of masonry are very small, considering the magnitude of the bridge. It was estimated that there would be about 100 cu. yds. of rock excavation, 540 cu. yds. of rock faced ashlar, 111 cu. yds. of broken ashlar, and possibly 200 cu. yds. of concrete. This, we suppose, includes the small foundations of the shore piers as well as the foundations of the arch itself.

Mr. R. S. Buck, Engineer in charge of the work, has sent us photographs showing the present state of the foundations, and we reproduce a general view of the Canadian side of the gorge, showing the foundation and the end of the old suspension bridge above, with its towers. We reproduce also a view of the abutments on the New York side. Of course the reader will remember that Mr. L. L. Buck is Chief Engineer of this bridge as well as of the 840-ft. arch to be built to replace the suspension bridge nearer the Falls.



Canadian Abutments of the Niagara Railroad Arch Bridge.

The Electric Road at Lausanne, Switzerland.

At the close of the International Congress of Electricians, held at Geneva a few months ago, many of the delegates made inspection trips through Switzerland, and visited the electric plants among the mountains in that country. On one of these "technical excursions," as they were called, the party examined the plant of the new electric railroad in Lausanne. Previous to the present installation the Mékarski compressed-air motors, and afterward cable cars were proposed as best suited to the hilly districts, but, after 25 years of agitation Lausanne is soon to be provided with an overhead electric system of the most improved construction. This is noteworthy, but it will be of greater interest to those connected with electric street railroads, to know that a gas engine, together with gas generators, form a part of the equipment. The more important features of the equipment of this line were described at the time by a member of the Association, in *Engineering*, from which we have been able to obtain some interesting facts.

The Industrial Electric Company, of Geneva, is building the road on the Thury system, similar to the Geneva line, "Sarconnex-Champel." Last year this latter line had a length of but four miles, but has since been extended to about six miles. The new power station of the Laussane road contains two gas generators of 130 H. P. each of the type made by Fichet & Huertey, of Paris. Taylor's system for generating the gas will be used. In this system, the air is pre-heated to a temperature of from 500 to 600 deg. before entering the generators. These are usually composed of iron pipes, through which air is blown or drawn and which are heated from outside by the waste gases of the furnace. The hot gases escape into a large pipe placed under the hearth sole of the generator. This sole, which can be turned about on its vertical axis, replaces the ordinary grate and is covered with iron scoria or refuse, over which the coal is heated. The gases escape above at a temperature of about 1,400 deg. Fahr., pass down into the soot-box and through a distribution valve into the washer, scrubber, purifier and finally into the gasholder. Anthracite coal is added from above once or twice every hour.

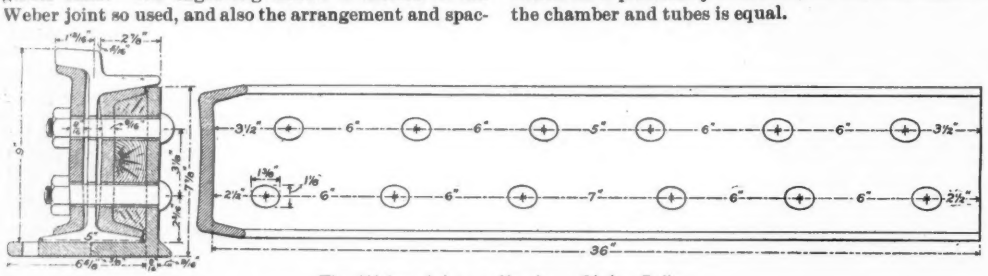
The two Crosby gas engines of 130 H. P. each are coupled to their dynamos by means of Raffard rubber rings, which are used to a considerable extent in Europe. The reserve power is furnished by a battery of accumulators of 200 H. P., known as the Marley cells. The cars are fitted with two motors and are from 10 to 14 H. P., connected in parallel with four poles and carbon brushes; the fuses are fixed outside and are easily accessible. The one lever of the controller, which serves

for all movements, can be taken off only in its neutral position. The cars are stopped by reversing the current. On very steep inclines wooden sleepers are placed beside the rails, on which a toothed iron block glides.

The trolley arms are of wood and end above in a short curved shoe fitted with bronze brushes. These shoes are simple and can very easily be put back in position if they leave the wire.

The Weber Joint for Girder Rails.

The Weber Joint Manufacturing Co. has adapted its well-known form of rail joint to street-railroad use on girder rails. The engraving shows a section of the Weber joint so used, and also the arrangement and spacing of the bolt holes. The joint is made on precisely the same principles as are embodied in the T-rail joint and the same claims are made for it, except that it is stronger, owing to the increased width and height. The wide base reduces the tendency of the rail to twist or turn over, and it is claimed that it is a permanent fastening requiring no tightening and that the joint ties require no more tamping than the intermediate ones, thus avoiding frequent tearing up of the pavement.



The Weber Joint as Used on Girder Rails.

Some of the experience with the Weber joint for steam railroads is embodied in a catalogue recently published. In this catalogue is found a table showing what happened when some Weber joints were applied near Rye Station on the New York, New Haven & Hartford Railroad. Four joints were there applied to old rails, the ends of which were from $\frac{4}{64}$ to $\frac{6}{64}$ of an inch low. In one week the same joints were from $\frac{3}{64}$ to $\frac{4}{64}$ low, and in 16 days two of them were $\frac{1}{64}$ low and two were $\frac{3}{64}$. After the joints had been in track three years and ten days three of them were up to exact surface and the fourth was $\frac{1}{64}$ of an inch low. The trackmen say that it is two years since they have tightened the nuts on these joints. In brief, the claim is that the Weber joint will cause the wheels to "iron out" depressions at the joints, and it is said that many miles can be shown where this result has been got, both on steam and electric roads.

Perkins Water-Tube Locomotive Boiler.

The engravings show a water-tube locomotive boiler patented by Mr. G. J. Perkins, President of the Perkins Water-Tube Boiler Co., La Crosse, Wis. The boiler shown is for an 18 in. × 26 in., class "D," freight locomotive recently built and now running on the Chicago Division of the Chicago, Milwaukee & St. Paul. There is an inner chamber, or tube chamber, filled with a series of vertical and diagonal tubes alternately disposed throughout its entire length. The chamber is composed of two sheets of ⅜-in. steel, with longitudinal seams on the sides, connected at the top with the crownsheet of the firebox and forming a continuation of the crownsheet. The sides and bottom of the chamber are deflected outward, where they join the firebox, the latter being made to conform to the chamber. At the front end the chamber is attached to the outer shell by means of a doubly-flanged sheet. Ample water space is provided between the inner and outer sheets.

The tubes are 2 in. in diameter and are expanded and rolled where they join the tube chamber and act as braces to prevent the collapse of the chamber. In this form of boiler the expansion and contraction of the tubes is found to be practically overcome, as the movement of the chamber and tubes is equal.

The drawing shown is of the third engine equipped with the Perkins Water Tube boiler by the Chicago, Milwaukee & St. Paul. The first engine of this description built has been in service three years and the second 21 months. Another engine with the Perkins boiler has been running on the Winona & St. Peter Division of the Chicago & Northwestern for the past six months and has shown no signs of leaking tubes. A great deal of trouble has been experienced on this division with the ordinary type of boiler from leaky flues due to the very bad water. The first engine in service on the Chicago, Milwaukee & St. Paul made a satisfactory showing in fuel, the second showed a slight improvement, due to the number of tubes being increased by 33. In the last engine built there are 173 more tubes than in the first, having in all 565.

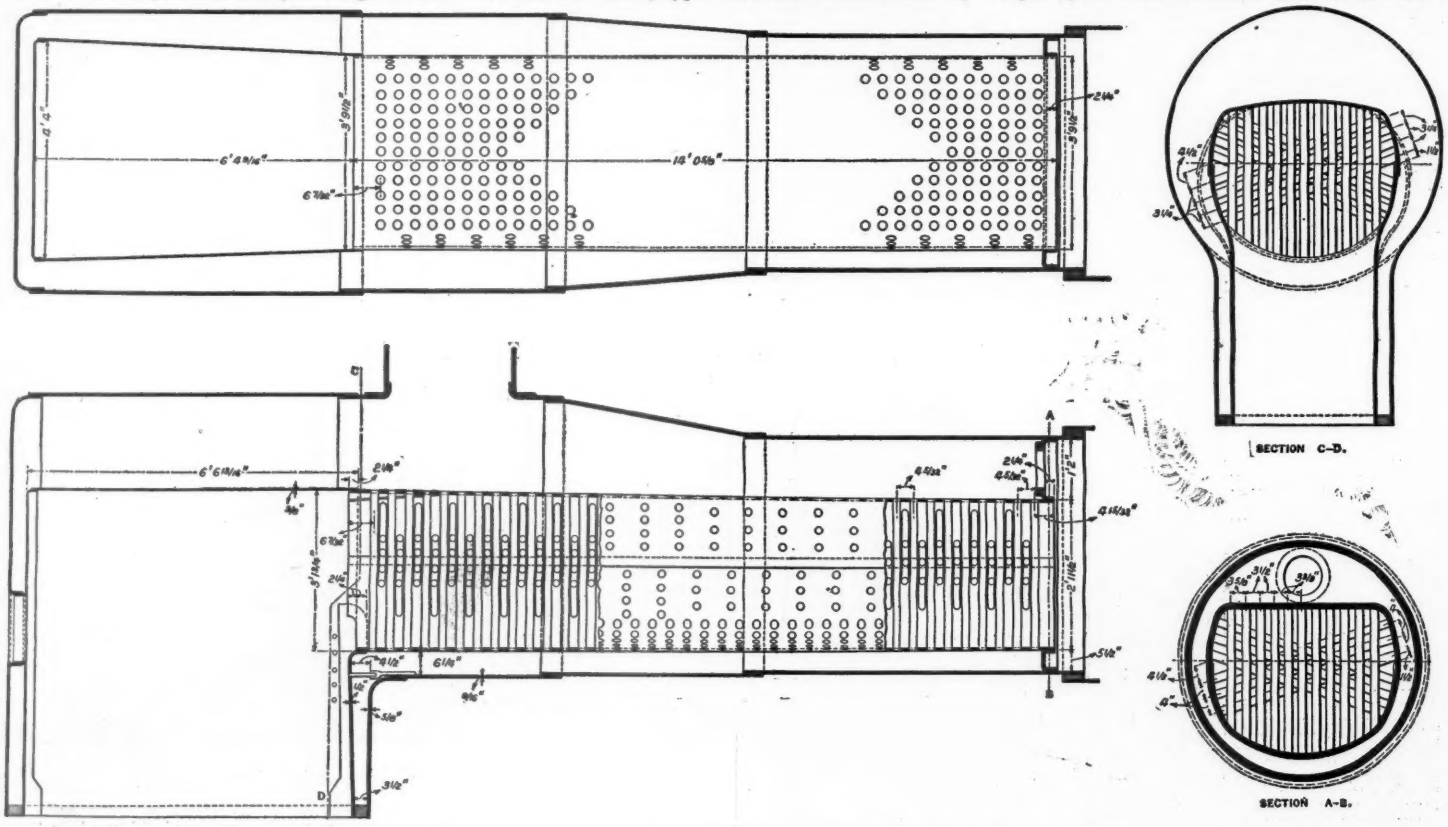
These boilers have a smaller heating surface than where the ordinary type is used, but owing to the better disposition of the tubes with respect to the heated gases more heat is absorbed during the passage of the gases through the chamber than when passing through the flues of the ordinary type. The cinders are broken up by coming in contact with the tubes so that no live sparks pass from the stack while the draft is sufficient to prevent cinders piling up inside the chamber.

With the engines so far built there has been no leakage at the tube joints, showing that the cause of leaking by expansion and contraction is overcome, although these engines have been always in service in districts where the water is bad.

These experimental engines show that a positive circulation of the water in the boiler is obtained and that the tubes are thereby kept clean, while the sediment is deposited in the bottom of the outer shell, where it can be readily washed out.

This arrangement of boiler can be applied to the ordinary locomotive at about the same cost as a new set of flues and flue sheets, and with entire new construction the cost is no more than the ordinary type. The tube chamber can be tested before being placed in position in the outer shell, and any faulty tubes that may afterward develop can be renewed by removing the dry pipe. Should a new set of tubes be desired the chamber can be taken out of the shell at the forward end with little expense.

Mr. G. J. Perkins, the inventor, has been a practical locomotive engineer since 1870, being last employed by the Southern Pacific. The right to use this arrangement of boiler is granted to railroad companies for 25 per cent. of one year's saving of fuel by its use, or a royalty for each engine equipped, and a saving of 10 per cent. is guaranteed or no charge is made for the use of the device.



Perkins Water-Tube Boiler—Class "D" Locomotive—Chicago, Milwaukee & St. Paul Railway.

Rapid Transit in Berlin.

The surface street railroads in Berlin, Germany, are worked with horses and trolley lines run from the outer boulevards to the suburbs. For years past efforts have been making by the great electrical companies to get concessions for elevated and tunnel railroads, and carefully prepared projects have been kept before the public and the city and state governments. As the horse railroads pay a good dividend and the franchise expires in 1901, only perfunctionary steps were taken by that corporation toward the introduction of mechanical traction. Yet the demand for it was universal.

The great industrial fair at Berlin, now open, has suddenly put life into the situation. A franchise was granted to a new corporation for a surface trolley line, with underground conductor, from the heart of the city to the fair grounds, and the railroad was built and put into operation. Thus rudely awakened, the old corporation applied for an extension of its charter until Dec. 31, 1919, and entered into a preliminary agreement with the city regarding a change of motive power on its entire system. The overhead trolley will be put in throughout, except in certain specified thoroughfares. Lines leading to the main system will use a mixed trolley and storage battery system.

In this system, already thoroughly tested in other German cities, a battery is installed in the trolley car, which is not removed from it except for repairs. The battery is charged from the trolley wires and runs the car where the wire ceases. The company must add double tracks in about 60 miles of street to its present system, the city paying one-third of the cost of construction from 1902 to 1907, and one-half from 1908 to 1911. The change of motive power must be completed within five years. The city will receive from gross receipts up to 6 million marks ($1,400,000), 4 per cent.; 7 million, 4½ per cent., etc.; 12 million, 7 per cent.; 13 million, 7¼ per cent., etc., up to a maximum of 10 per cent., payment to begin when the motive power of one-half the system has been changed, but not later than three years from date of contracts. On Jan. 1, 1920, all the tracks, poles, wires, feeders, waiting-rooms and other property of the company in the streets become the property of the city free of charge.

The prospects of the tunnel railroad project are also vastly improved. An inner and an outer ring and two diametrical lines crossing at right angles are contemplated. A test tunnel has been driven to connect the two river banks at the fair grounds.

The subsoil of Berlin is mostly sand and grave doubts were entertained of the practicability of tunnelling under the streets without damage to abutting property. A piece of retaining wall, with fine sand built up high

behind it, was built over the test tunnel. The bottom of the tunnel is 35 ft. below high water. A shield and compressed air were employed. The quantity of sand taken from the tunnel considerably exceeded its cubic contents. The retaining wall settled and cracked and holes formed on the ground to the right and left of the tunnel. Alterations made in the construction of the shield obviate these defects and a concession for the entire tunnel project will now likely be granted. The tunnel is a circular pipe of 13 ft. diameter, built of mild steel plate segments, which are lined with cement on both sides The daily progress varied from 2 to 6 lin. ft.

A New Boring and Turning Mill.

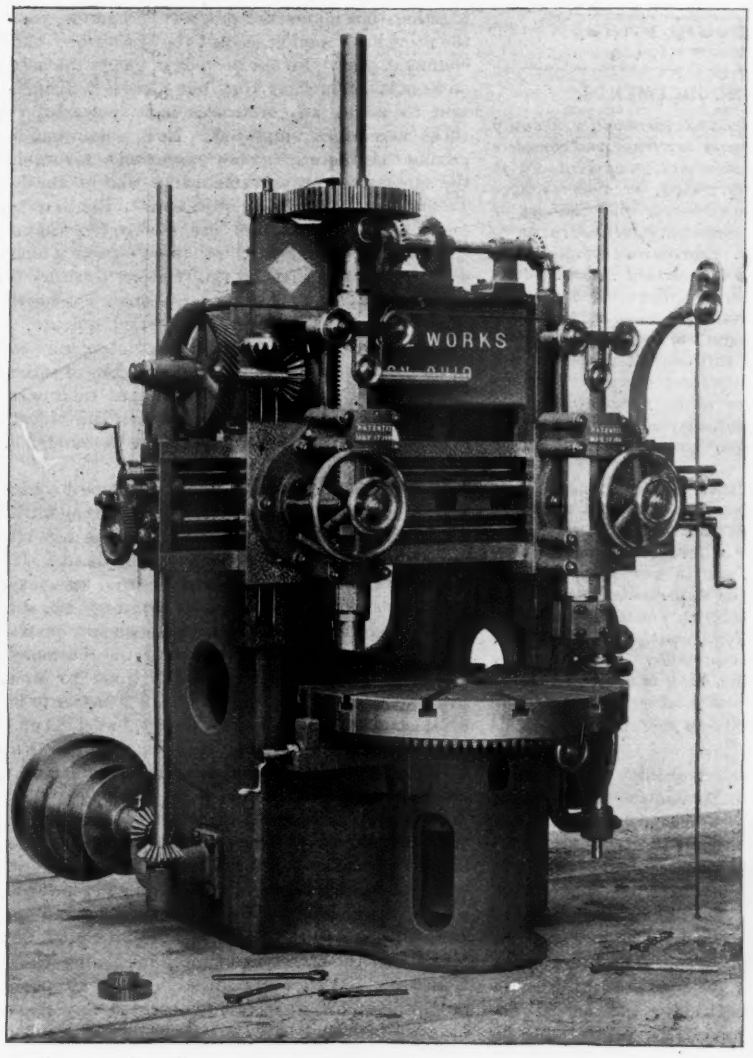
The accompanying engraving shows a new 37-in. boring and turning mill, recently built by the Niles Tool Works, Hamilton, O.

This machine, in addition to the standard head, has an independent boring head, especially adapted to work which requires boring or drilling that cannot be done with the standard head, such as the holes in eccentrics and similar work. The standard head is so arranged as to swivel and can be used for turning and boring both tapered and straight work.

The independent head is driven from a separate counter shaft and cone which transmits motion to the vertical shaft shown on the left-hand side of the machine, which in turn drives the pinion meshing with the large gear on the boring spindle which passes through the bar of the left-hand head of the mill. It will be noted that the head is adjustable on the rail, so that it can be used on work from the center of the table up to a diameter equivalent to the full swing of the machine. This independent boring bar is adjustable for wear, is counter-weighted and arranged with power speed the same as the standard.

The table is clamped by the device shown on the left-hand side, so that it can be held in position when the independent mill is being used. This head can also be used the same as the standard head.

It will be noted that a large amount of work, requiring separate boring and two settings on different machines, can be performed, using this machine, by a single clamping of the work and hence making a material saving on the cost.



Boring and Turning Mill—Niles Tool Works

The Motors of the Baldwin-Westinghouse Electric Locomotives.*

Unless otherwise specified "iron-clad" consequent-pole motors are used. The external appearance of these motors is illustrated by the accompanying engraving Fig 1 shows the motor with the cables leading to it, as it appears from the side where the axle brackets are placed, and Fig. 2 shows the motor complete. These motors are entirely encased by thin steel shell, so that they are practically free from injury under all normal conditions of service.

The armatures are laminated, and made up of thin slotted discs of steel. In the slots are placed the armature wires. The commutators are of the best forged copper, with mica insulation. These motors are of modern construction, with ventilated armatures, steel fields and the highest grade of insulation. Only the most perfect material is used, and all machines are tested to their full capacity before shipment.

Present Status of the Distribution and Transmission of Electrical Energy.†

BY LOUIS DUNCAN.

(*Concluded from page 698.*)

Methods of Electrical Transmission.

Coming to the question of transmission of electrical energy as distinguished from the supply to customers from distributing centers, there have been great advances made in the last few years, and these mainly through the introduction of multiphase alternating currents. Single-phase alternating currents permit the transmission of power to long distances and its distribution for lighting purposes. It is also possible to supply power from such circuits to large motors working under a steady load. It is not possible, however, to distribute power economically for ordinary uses. As most long-distance transmission schemes contemplate the substitution of electric motors for steam engines, and as their success will, in many cases, depend upon the possibility of such substitution, single-phase alternating currents are not at present able to comply with the conditions imposed by the desired service. The introduction of multiphase alternating systems, or where two or more alternating currents are employed, the currents differing in phase, has completely changed the situation with respect to long distance transmission, I shall consider briefly the possibilities of such systems and their value as compared with any direct-current system.

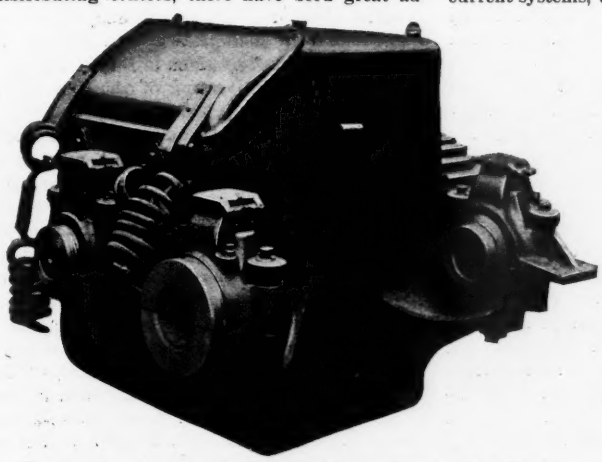


Fig. 1.—Consequent-pole Railroad Motor, Showing Axle Brackets.

Continuous-Current Transmission.

The first long-distance transmission plant was operated by the continuous-current system, and even now plants are being built in which continuous current of high potential are used to transmit energy to distances up to 15 miles. As compared with transmission by means of alternating currents, we will find that the continuous-current system possesses some advantages and some disadvantages. If we consider the relative cost of the copper in the line for a given amount of power transmitted and for a given maximum potential between the conductors, we will find that the relative amounts for the continuous-current and the different alternating-current systems, will be as follows:

Continuous current.....	100
Single-phase alternating	200
Two-phase "	200
Three-phase "	150

We see, then, that the continuous current has a marked advantage over the alternating-current systems as far as the cost of copper is concerned. There are, however, certain practical disadvantages belonging to this system. The high voltages necessary for long-distance transmission make it impossible to distribute the current at the receiving end without first reducing the voltage. With continuous current this can only be done by employing a rotary commutator of some kind. A plan which has been practically and successfully used has been to run a number of dynamos in series at the generating end of a line, while at the receiving end are a number of motors, also arranged in series, which are used to drive other generators to give the required type of current and the desired voltage. It has not been found possible to make either dynamos or motors of any great output, as there are practical difficulties in running dynamos of high potential where the current taken from them has a considerable value. M. Thury has installed a number of continuous-current transmission plants that have apparently given excellent results. At Biberist a transmission of 15 miles is employed. At Brescia 700 H.P. are transmitted over 12 miles at a maximum of 15,000 volts. M. Thury states that generators for 45 amperes can be constructed up to 3,000 volts, and he thinks that 4,000 could be successfully used. These machines, however, are small when compared with the 5,000-H. P. dynamos in use at Niagara, for instance, and where the transmission is a large one the great number of machines necessary would be a serious objection to this type of transmission. It will be seen that the greatest possibility of trouble, in such a transmission, lies at the ends of the line, in the generating and receiving apparatus. It is necessary, no matter what our voltage is, that both the dynamos and motors shall be directly subjected to it, and this with commutated machines will always be a source of danger. If we are to do any considerable amount of lighting from such a station, our energy for this purpose undergoes three transformations before it reaches the lamps, and the efficiency would not be so high as in a corresponding alternating-current system. It would hardly be possible to supply motors for ordinary work at the high voltages used for transmission, and the current for them would have to be transformed in the same manner as the current for the lamps. It must be recognized, however, that this system has been successfully used and has given excellent results in a few cases of transmission. Its great advantage lies in the decreased amount of copper as compared with the alternating systems, and in the absence of induction effects, which are a drawback to alternating current transmission.

Transmission by Alternating Currents.

A large proportion of the transmission plants that have been installed in the last few years have been of the alternating-current type. These have, as a rule given satisfactory results, and the installations that are now being erected or planned are almost exclusively on an alternating-current basis. The great advantage of this system lies in the fact that it is possible to change the voltage of the current without the use of rotating apparatus, and at once economically and safely. Low-voltage dynamos may be used, the voltage may be increased in any desired ratio by stationary transformers, the energy may be transmitted at an increased voltage and at the receiving end the voltage may again be reduced by transformers. If we compare this method with the continuous-current system, we will see that to obtain an alternating current of the required pressure at the receiving end of the line, we would use the same number of transformations required by the continuous-current system. We have the great advantage, however, that our changes in voltage have been obtained by the agency of stationary apparatus, which is much cheaper, is more efficient and is safer than that required in the continuous-current system. It is possible to increase the voltage by means of transformers to almost any value with perfect safety and with an efficiency as high as 98 per cent. or 99 per cent. If then our alternating current, when it has been reduced at the receiving end, is as valuable for distribution as the current obtained by the direct-current system, there will be no doubt that alternating transmission has great advantages over continuous currents.

I have spoken of the relative amounts of copper required by the single-phase, two-phase and three-phase alternating currents. I do not think it necessary to explain minutely difference between these systems, as they are well understood. In a single-phase system a single-alternating current is used. In a two-phase system two-alternating currents whose phases differ by 90 deg. are employed, while in the three-phase system there are three currents differing in phases by 60 deg. I shall consider the characteristics of these three systems, as there has been much discussion, especially as to the relative value of the last two of them for transmission work. I shall not discuss the various modifications of the systems, but shall confine myself to general considerations. There is no single-phase motor in successful commercial opera-

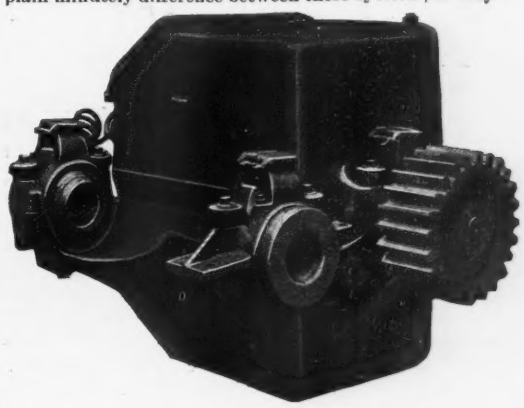


Fig. 2.—Motor Complete, Showing Axle Brackets and Pinion.

(*Continued on page 724.*)

*From the Baldwin-Westinghouse Catalogue of Electric Locomotives.

†President's address at the New York meeting of the American Institute of Electrical Engineers, Sept. 23, 1896.

RAILROAD GAZETTE

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Published Every Friday,
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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The *Financial Chronicle's* monthly statement of railroad gross earnings for September shows a very small decrease (0.42 per cent) as compared with a year ago. In August the loss reported was $1,082,000 (2.61 per cent.). The smaller decrease loses much of its apparently hopeful significance when it is remembered that August had one more working day and September one less working day than the corresponding months in 1895. The total gross earnings of the month of 122 roads, working 94,614 miles of road, were $43,266,000, the actual decrease being $184,516. Though the decrease in the total was small, the comparison is with a year of poor earnings. How small is the monthly aggregate of earnings now reported may be seen by going back to 1893 and the two preceding years. In September, 1891, the gross earnings were nearly 49 million dollars; in 1892 over 50¼ millions; in 1893 they fell off nearly five million dollars to 45¼ millions, but in that year were nearly 2¼ millions greater than in 1896. For the year to Sept. 30 earnings of over 342¼ million dollars are reported in 1896, an increase of nearly 15 millions as compared with the same nine months in 1895, and larger also than in 1894. The gain was made in the early months of the year when the outlook was favorable. A special feature of the earnings in September was the favorable showing of the Southern group, which reports an aggregate increase of $273,000. The Southern roads have been reporting large increases each month this year over 1895, except in August, the large 1895 cotton traffic having given a heavy business, which continued later than usual. The present crop, also large, is already affecting earnings, beginning to move unusually early. We have prepared the following tabulation to show the results by groups:

	1896.	1895.	Inc. or dec.
Trunk lines	$8,860,712	$9,043,696	D. $182,984
Middle & Western	6,073,775	6,145,906	D. 72,131
Southern	6,234,243	5,961,486	I. 272,747
Northwestern	8,045,991	8,290,733	I. 253,742
Southwestern	5,693,760	5,421,306	D. 269,454
Pacific	3,890,552	4,370,643	D. 480,091

The two groups reporting better earnings embrace the roads benefitted by the cotton movement. The heaviest decreases reported are by the spring wheat carrying roads, and the statistics of the movement of these crops account for these increases and decreases in earnings. Cotton receipts at Southern ports in September were nearly 2½ times as heavy as in 1895, or 528,000 bales more in fact, the receipts having been 901,000 bales. The overland rail shipments were 69,000 bales, about four times as many as in 1895. Grain shipments fell off in many sections in September, the loss being especially marked in the spring wheat districts, which had fine crops in 1895. The winter wheat roads did not fare so badly. The total wheat shipments from the leading Western markets were 32 million bushels, roughly one million bushels less than in 1895. But Duluth and Minneapolis, the ports receiving spring wheat, had about three million bushels less than in 1895. All the winter wheat points show a greater movement than last year.

Orderly Traffic Competition Versus Disorderly.

Discussion is kept up at Chicago concerning what ought to be done to form a new traffic association in the territory west of that city, or to pull the old one together, but no marked progress is reported, though the prevailing opinion seems to be against any radical change of plan. No one nowadays denies the need o an association of some kind, but there is a disinclination to adopt any restraints more powerful than those heretofore employed. It is somewhat surprising that there are so few expressions favorable to the adoption of an agreement like that of the Joint Traffic Association. The objections to the New York plan thus far mentioned are mostly too vague to be dealt with seriously, but there is one which is definite, to wit, that in the Western territory they cannot get along with anything so slow. The hustling West must have all questions settled quickly. As the roads in the Joint Traffic Association are nearly or quite unanimous in their expressions of satisfaction with the results of the working of their organization, we may fairly question whether this objection is intelligently made and whether it is founded on a real fault.

To say that questions must be settled quickly means, really, by fair construction, that they must be settled quickly *or not at all.* Are the objectors ready to add those four words to their complaint? If so, it is answered by the fact that in the associations heretofore existing in Western territory the alternative has had to be accepted. Important questions have had to remain unsettled, and the harmony of the rate situation has repeatedly gone to smash. Practically, then, the question is, is it better to have an association which moves slowly, but stays on the track, than to try another like the old one, which theoretically moves faster, but which runs into the ditch at every obstacle?

As there is no practical standard by which to judge just what degree of celerity ought to be accepted as satisfactory in an association dealing with intricate questions concerning business which is scattered through a territory of 200,000 square miles, involving questions affecting 30 railroad companies, it cannot be asserted that the managers of the Joint Traffic Association have settled every question with all possible promptness; but we have not observed any marked differences in time between the results accomplished during the last nine months and those of former years; certainly no differences unfavorable to the new association. That the changing of a rate—say, the corn rate from Chicago to the seaboard—requires consultation, negotiation and the harmonizing of differences which are very strenuously maintained, is too obvious to need to be stated. This is likely to involve a good deal of delay. The way this delay used to be avoided was for individual roads to make rates independently, and generally secretly. Does anyone pretend to wish to compare that methods with the present? Certainly no road represented in the Board of Managers has made such comparison except to express the heartiest satisfaction with the saving of hundreds of thousands of dollars of revenue which has been effected by the abandonment of irregular warfare and the substitution for it of orderly negotiation.

In view of the misgivings that were apparent on all sides up to December, 1895, it would have been cause for gratulation if the Joint Traffic Association had succeeded in coping with ordinary conditions; but in point of fact the conditions of 1896 have been extraordinary. General traffic has been exceedingly dull, making every traffic manager ravenous for "tonnage." The export corn traffic, which has been such a valuable help out of bad sloughs on previous occasions was this year competed for by one powerful and two or three less powerful lines to the Gulf of Mexico; and they not only competed, but got some of the grain, and a lot of provisions also; and the conditions of ocean traffic from New Orleans and Galveston favored them. And besides outside competition, the Trunk Lines have had hard questions in their own family. The Chesapeake & Ohio, with little local traffic to deter it from making every effort to get export grain, must have taken quite different views from those of the lines which could make more money by giving up the seaboard business and maintaining rates on grain for interior points.

The Board of Managers has had to deal with many questions which were practically new—new, we mean, for an association to deal with. Where a road was found paying cartage or elevator charges or some other item, petty in itself, but yet of a character to affect competition and thus to start, as such things have started, times without number, a rate war involving enormous losses, the case had to be dealt with as carefully as though it were a 25 per cent. reduction of through rates. Under former conditions these minor issues were for a brief time the subject of acrimonious discussion and then each man went home and did what he pleased, keeping his acts covered up as much as possible. Even where a question of this kind could have been settled with less investigation, the managers had no alternative but to study the subject thoroughly, because it is necessary, in the beginning of the association, to lay sure foundations at every point.

This is not an apology for the managers and we do not know whether they will like to have us print what appears so much like one, but we think at least a brief statement of this kind is due to every person who has doubts of the usefulness of this instrumentality for preserving stability of rates. The unequivocal expressions of approval which have appeared in annual reports and from presidents through other channels have not been based on mere hopes, but upon tangible results.

It is difficult to see how any difference in the number or character of the problems to be dealt with should make any difference between the Eastern and the Western territory, as far as the applicability of the new methods is concerned. It is true that at some points in Western territory the competition appears to be more intense than in older territory, where the railroads and the industries are more settled in their methods, and the soliciting agents are naturally more conservative. It is true that different competitive fields overlap each other more confusingly than anywhere else on earth, or at least that it seems so. No one has claimed that the Joint Traffic Association can accomplish impossibilities, but it is fair to claim, and difficult to deny, that its methods are the best attainable, whatever the nature of the problem to be dealt with. If the satisfactory adjustment of rates on Nebraska corn is forever impossible; if the lines which want to carry this grain to Europe, via Duluth, and those running via Kewaunee, and the Chicago lines and the I., I. & I. and the Memphis bridge, and the Illinois Central line to New Orleans and the air lines to Galveston have interests so diverse that they can never adjust them harmoniously, why, so be it. But the point is that it will be immeasurably better to reach this conclusion by means of an orderly, dignified discussion than by the negative process of learning through the newspapers that a competitor, who has his office a thousand miles away, "has applied the knife" to rates, and to hear from him some time afterward that he has so little business courtesy that he has decided not to attend a conference of roads.

We repeat, that the strength of the Joint Traffic Association, so far as it depends upon methods and not on men, lies in the regular and constant conferences and in the pledges of companies to take no individual action except by a formal vote of the directors. If this is slow, who can recommend anything faster? The present Western agreement, with its easy provision for individual action, is no better than the veriest rope of sand that an irresponsible traffic official ever devised.

Fuel Loss Due to Forcing Locomotives.

I.

The latest and perhaps the most accurate reliable evidence about the loss of efficiency of locomotives that arises from small grate areas and excessive forcing of the fires, is that given in Prof. Goss' paper before the September meeting of the New York Railroad Club. (See *Railroad Gazette*, Sept. 18, 1896, p. 651.) The evidence is accurate because taken with the best modern instruments, and reliable for the reason that it has been worked up and presented by persons having no object in coloring the conclusions which might be logically deduced from the results.

The *Railroad Gazette* has often called attention to the important conclusion pointed at by many locomotive tests, that a very great loss arises from using too small grates and too little firebox heating surface for locomotives doing heavy work. The present results from the Purdue testing plant give further confirmation, and in a way that is indisputable, so far as the results go. In fact, Prof. Goss' data indicate more loss from forcing than one would have felt justified in predicting from the evidence before available.

In the first place, the results show, as indicated by Fig. 1, a loss of 40 per cent. in fuel, due to forcing within the limits of common use of locomotives. Correspondence with Prof. Goss has brought out the fact that Fig. 1 is the result of 40 carefully made tests.

Fig. 1 teaches that within the limits of common use of such a locomotive the evaporation of water reduced to the standard of comparison, namely "from and at 212 deg. Fahr.," varied 40 per cent. When coal was used at the rate of 60 pounds per square feet

of grate per hour, which is about the least rate at which fuel is used on such a locomotive, eight pounds of steam was made for each pound of coal used. When the fires were forced so that 200 pounds of coal was used per square foot of grate per hour, only about 4.6 pounds of steam was made for each pound of coal; 200 pounds is about the maximum forcing to which such locomotives are subjected. Between these limits the loss in fuel was about 40 per cent.

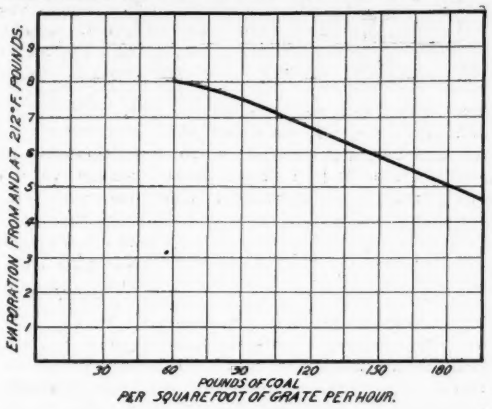


Fig. 1.

We can see from this why it is that English and foreign locomotives, which are less forced, are generally more economical in the single factor of "fuel used per train-mile" than the American. This point was brought out in Mr. Barnes' paper before the International Engineering Congress of the Columbian Exposition in 1893, on the "Distinctive Features and Advantages of American Locomotive Practice."

As the data gathered by Prof. Goss have been somewhat misunderstood and taken to mean what they should not be assumed to show, we change the basis of comparison under the different conditions from pounds of "coal per square foot of grate per hour" to total fuel burned or used per hour. Fig. 2 has been made on this basis directly from Fig. 1. It shows how the

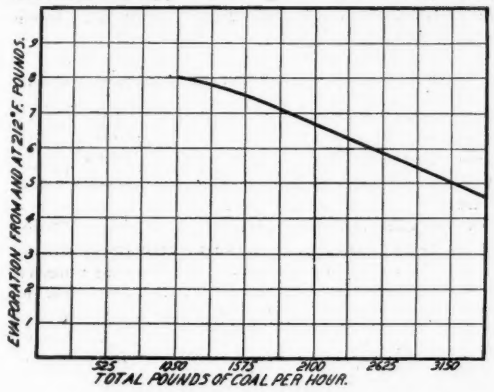


Fig. 2.

steam made per pound of coal used is reduced as the total amount of fuel used is increased.

The important thing to be borne in mind here is that in these 40 tests, the results of which are given in Figs. 1 and 2, *the locomotive was not changed*, but remained exactly as in service with the same heating surface; practically the same apparatus, the only difference being that more fuel was shoveled into the firebox and the draft was made greater in order to use it. Also, it should not be forgotten that the efficiency of the cylinders, valves and link motion and steam-using apparatus are not connected in any way with these results. These diagrams show the loss from the boiler alone, the engine part may have been less or possibly more efficient, while the boiler was working with the evident disadvantage of forcing. This cylinder factor is, however, another matter, and should be taken up independently.

One naturally inquires now, how can such losses as are here indicated be reduced? Professor Goss has set out with the right idea, to first locate the losses; but whether he has used such an apparatus as will give the true location of the losses, is an open question. We think he has not, and in what follows shall try to set forth the reasons for that opinion.

The two ways in which forcing may cause a loss are: Imperfect combustion; and overcrowding of the heating surface. Imperfect combustion in the sense here used includes all losses due to wrong air supply and the formation of sparks which pass out of the stack unconsumed. Overcrowding of the heating surface means, in the sense here used, a temperature of the gases so high that the heating surface will not take up the heat before the gases pass to the stack. Now heating surface is of two kinds in a locomotive boiler and should always be so considered, namely, that which is exposed to the radiant heat of the fire, which may be called the "direct heating surface;" and that which only comes in contact with the heated gases, and may be called the "indirect heating surface." Each square foot of direct heating surface exposed to the fire will do more work than ten square feet average of the indirect heating surface, which is mainly made up of the interior of the tubes. From this it appears that the firebox heating surface in proportion to the fuel burned per hour is a mighty important factor, and that a large firebox area of heating surface might reduce materially the loss from forcing. So also would a large increase in the tube-heating surface, as has been well shown by the experiments made in France on the Paris, Lyons & Mediterranean Railroad. (See *Railroad Gazette*, January 25, 1895, pages 48 and 55.)

These French tests, however, show that a long tube interferes with the draft and that locomotive tubes are long enough as they are, so that if there be any material increase in tube-heating surface it must come from increasing the number of the tubes and the diameter of the shell of the boiler. This same conclusion has been reached in this country from the practical working of locomotive boilers, and now as many tubes are used as possible without interfering with the circulation and facilities for cleaning the interior of the shell.

There is a limit, and a well defined one, the weight of the locomotive, which prevents in any given case the increase of the tube-heating surface above a certain point, and when this point is reached designers have to look to an increase of firebox heating surface to keep up a reasonable efficiency when the locomotive is forced. This among other things has led to the use of larger grates, for with such grates the heating surface in the firebox is generally increased and is always placed in a better position to take up heat directly from the fire. It has been the observation of the everyday action of locomotives with large grates and the effect of forcing that has led to the conclusion that the larger grate with the less rate of combustion does of itself give better efficiency. The combustion is more complete and the direct heating surface, which comes incidentally with the large grate, absorbs more heat from the fuel. Professor Goss's tests are supposed to show whether this is so or not. Now it happens that, since the publication of his results, those who had formerly taken Figs. 1 and 2 to indicate that a large grate would, of itself, without the incidental better heating surface, reduce the evils shown by those diagrams, must look further and see whether they have not been misled. Such a reflection is necessary, as it materially affects the selection of the proper design of boiler for new locomotives.

Prof. Goss' results, on the surface and without analysis, indicate that when the rate of combustion is increased from 60 to 200 lbs. per square foot of grate per hour, the loss in efficiency of the boiler is about 13½ per cent., and of this loss all but about 5 per cent. is due to the increased generation of sparks. That is to say, it would appear on the face of the tests that the enormous increase of the rate of combustion from 60 to 200 lbs. per square foot only caused about 13½ per cent. loss of efficiency, of which 8½ per cent. came from the heavier draft and increased amount of sparks. Inasmuch as very few sparks will be collected when the rate of combustion is but 60 lbs., and the indications from these results are that an additional 8½ per cent. of all the fuel used will be made into sparks when the rate is increased to 200 lbs., the spark results look reasonable, and it may be assumed that for all practical purposes at present the spark losses as determined by Prof. Goss may be taken as correct. It seems worth while to draw the spark diagram by itself and assume for the present that it represents the condition existing on American locomotives where the fuel is of good quality similar to the Brazil block used in these tests. This diagram, Fig. 3, indicates how much a larger grate would increase the efficiency by reducing the sparks.

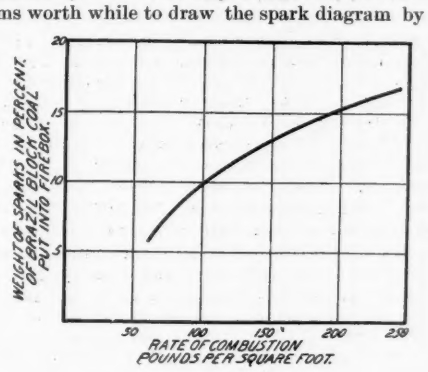


Fig. 3.

The small remainder, namely 5 per cent., change in efficiency of the boiler, as shown by Prof. Goss' tests, would, without further explanation, apparently be the entire loss, outside of spark losses, brought about by a change in the rate of combustion from 60 to 200 lbs. per square feet of grate per hour. It is this evident wrong conclusion that might be drawn to which attention is now called, and we shall consider this paper further next week with this in view.

The Movement in the Railroad Bond Market.

Stock exchange values of railroad securities have fluctuated widely in the last few months, and have been, of course, greatly influenced by political developments. While the real value of a property is not always represented by the price of its securities on the stock exchanges, such quotations, as a rule, reflect pretty accurately the public estimate of the value of securities, which makes market value. That is of more consequence when securities are to be bought or sold than any other value.

The effect of the threatened unsettlement of the financial basis on market values can be shown definitely in no other way so well as by the Stock Exchange quotations. This threat in its varying phases has been the predominant factor in bringing about the changes in values which we record, although speculative manipulation has been frequently important. The earnings reported by the railroads have not been specially unfavorable; the crops have been good, but earnings and crop matters have been largely lost sight of, in the larger political question, or at any rate, have not influenced quoted values as they usually do.

The figures which we publish enable an estimate to be made of the depreciation already caused in the values of one class of investments by the strange campaign now waging. The cost in diminished production can only be indicated in a general way. The New York Stock Exchange quotations show that the high point of the midsummer stock market was reached on June 17, in discount of the nomination of Major McKinley for the Presidency on a sound money platform. The price of 20 active stocks representative of the market movement on that date was 55.26 per cent. But apprehension as to the action of the Democratic convention at Chicago checked the upward movement, The meeting of the convention was followed by a serious unsettling of values, the quotations of the stocks included in the average named above declining 13.44 points from that figure to 41.82 in August. This latter average was several points below the lowest point of the 1893 panic. Subsequently, up to and including Oct. 3, the market rallied, the recovery in the 20 stocks being 8.04 per cent. of the 13.44 lost. This established an average of 49.86.

The three dates were pivotal market points and are selected for a review of the railroad bond market. In a general way it may be said that the decline in bonds was not as severe as that in stocks, despite the liquidating character of the sales.

During the first week of August there was little demand for securities and at times no sales could be effected. In spite of this absence of purchasing demand the stability of the bond quotations, as shown in the table, is surprising. No such record was made by stocks, those holdings being generally of a more speculative nature. Indeed, the quotations for the two classes of securities indicate that the speculative element was the controlling factor in fixing stock quotations and that advantage was taken of the general feeling of uneasiness and distrust to attack the values of those securities which would be the least strongly supported.

In striking an average of the movements by the various groups it is shown that the recovery in nearly every instance has been 50 per cent. or more of the decline. From this it is argued that if bonds were intrinsically worth the prices at which they sold in June they are worth equally as much to-day, and offer an inviting field for investment, being from 40 to 50 per cent. below the level from which they fell during the silver scare. With few exceptions, every bond issue has recovered part of the loss of early August. These exceptions are due to individual causes. The issues of the Brooklyn elevated lines are lower now than previously, owing to continued poor earnings. The Receivership of the Louisville, New Albany & Chicago and the October default on the Consolidated six per cent. bonds explains the weakness in those issues. The losses in this company's securities were excessive, amounting to 32 in the 5s and 26¼ in the 6s, and increased the average decline, whereas their failure to react kept down the average recovery. In the balance of this group the movement was about normal. The improvement in Reading incomes and general mortgage 4s was substantial in the last week in September. The average loss in the Receivership group (11.31) is greater than in any other.

The Trunk line bonds were very firmly held all through the midsummer panic and were quick to respond to better conditions. In fact they followed the course of government bonds closely. The average decline was materially increased by comparatively large losses in the various Erie issues. However, the recovery in these has been as pronounced as in any of the others.

In the Southern group the Southern Railway 5s lost 18½ per cent., the greatest loss in this group, and undoubtedly due to selling in consequence of the Southern rate war which at one time seemed to threaten very

seriously the earnings of the roads in the South. The Louisville & Nashville was directly affected by this same factor and lost heavily.

Next to the Receivership group the Southwestern roads suffered the most severely, a not remarkable fact, in view of the nature of the securities and charater of the holdings. Of the 17 issues quoted in the accompanying table, only one sells at par or above. The recoveries were fully up to the average. The rate wars in this region, on provisions and grains, had considerable to do with the heavy losses in values. The most representative movement in the group was in Atchison 4s. Large amounts of these securities were sold both by foreign and domestic holders.

The Grangers as a group were stable owing to their high-class investment character. Nevertheless, there were some severe losses, for example, a drop of 12 points in St. Paul gold 7s, which have a high character as investments. In this group is more clearly evidenced than elsewhere how bondholders were forced into the market as sellers, by their fears or needs.

The table immediately following shows the average decline and the average recovery of each group in the periods noted:

	Average declines.	Average recovery.
Trunk lines	8.4	4.93
Southern lines	9.34	5.18
Coalers	8.67	5.67
Transcontinental	6.66	2.00
Southwestern lines	10.00	5.31
Receivership roads	11.31	4.98
Grangers	8.56	4.38
Miscellaneous roads	7.16	3.66

Following is given the prices June 17, Aug. 8 and Oct. 3 of representative bonds:

	June 17	Aug. 8.	Oct. 3.
Trunk Lines.			
Erie 1st con. 7s	140	131	134
Chic. & Erie 1st 5s	109½	101¼	109½
Erie prior lien 4s	93	83	89
Erie gen. lien 3-4s	66¾	54½	62
New York Central 1st	120¾	112	116½
West Shore gtd. 4s	107¼	100⅜	104
N. Y., Chic. & St. Louis 1sts	104¼	99½	102
Penn. 1st 4½s	113¾	105½	109⅝
Average decline	8.4		
" recovery	4.93		
Southern Lines.			
Louis. & Nash. gen. 6s	116	110	112
Louis. & Nash. unified 4s	79½	68½	73⅛
Mobile & Ohio gen. 4s	66⅞	56	65
Nash., Chat. & St. L. con	101	93	95
Southern Railway 1st con. 5s	94½	76	85
East Tenn., Va. & Georg. div. 5s	112¾	107	111½
" " " " con. 5s	107¾	100⅛	105
Richmond & Danville con. 6s	121¼	110¾	117
Virginia Midland gen. mtg. 5s	101	94	98
Average decline	9.34		
" recovery	5.18		
Coal roads.			
Cent. of N. J., gen. 5s	120	110	111
Morris & Essex, 1st 7s	139⅝	128	139½
New York, Ont. & West, ref. 4s	88	82	85
New York, Sus. & West., 2d 4½s	69	63	68
" " " " gen. 5s	70	60	68⅝
Average decline	8.67		
" recovery	5.67		
Transcontinental.			
Denver & Rio Grande, 1st 4s	92	83	86
Rio Grande West., 1st 4s	77	67½	69⅝
St. Paul, Minn. & Man. Con. 6s	124½	113	119
" " " Dak. ext	119½	114	117
" " " Man. Con. 4½s	106	100	102
" " " Mont. ext. 4s	98	87	88
Average decline	6.66		
" recovery	2.00		
Southwestern.			
Atch., Top. & Santa Fe gen. 4s	80⅛	68¼	74⅛
" " " " adj. 4s	42⅞	28¾	36½
Int. & Gt. North 2ds	73½	60⅝	67
Mis., Kan. & Tex. 1sts	84	75½	80¾
" " " " 2d	50	44	51½
" " " " of Tex. 5s	78⅛	69¾	71
Mis., Kan. & East. 1st	93	81	88½
Missouri Pacific con. 6s	89	78	83
St. L., Iron Mount. & So. gen. 5s	79⅝	68	75
St. Louis Southw. 1st 4s	70	65	68⅜
" " 2ds	26½	23½	27
San An. & Arkansas Pass 1st 4s	58	46	54
Texas & Pac. 1st 5s	88	73	80¾
" " 2ds	22½	13¾	18¾
Wabash 1st 5s	107	90	104⅞
" 2d 5s	75½	64¼	68
" deb. series "B"	25¼	18½	21½
Average decline	10		
" recovery	5.31		
Roads in control of Receivership.			
Colo. Midland 4s	23½	18½	18½
Ft. Worth & Denv. City, 1st 6s	58	46¾	52
Louisv., N. A. & Chic. 1st	114	110	102½
" " " con. 6s	100¾	74	74
" " " gen. 5s	72¼	40	40
Northern Pacific 1st 6s	117¾	109¾	113⅛
" " 2d 6s	115¾	103	108¼
" " 3d 6s	73	59	67
" " con. 5s	50	36	46⅛
" " col. trust notes	92	80½	90⅜
Chic. & Nor. Pac. 1st 5s	45½	35½	40½
Ohio South. 1st 6s	89½	73	89
Oregon Improv. 7s	90	75	73½
" " con. 5s	17⅝	8¼	12
Oregon Railway & Nav. 1st 6s	112½	104	108¾
Phila. & Read. gen. mtg. 4s	80½	73	76¾
" " " 1st incomes	*34¾	*27	†36½
" " " 2d "	*22½	*16	†25⅝
" " " 3d "	*20¾	*12¼	†24
Pittsburgh & West. 1st 4s	76	66	70
St. Jos. & Grand Island 1st 6s	47	37	40
St. Louis & San. Fran. gen. mtg. 6s	114	100	107
" " " " 5s	99¼	93	93¾
" " " " 2d class "C"	116	108	113
Tol., St. Louis & Kan. City 1st	70	62½	65
Union Pac. 1st 6s, 1896	104½	100¾	105
" " 1st 6s, 1897	104⅝	100	104
" " 1st 6s, 1898	105⅝	100	103
" " ext. sink. fund 8s	91	77½	75
Kan. Pac. con. 6s	72¾	56¾	66
Union Pac. Den. & Gulf 1st	37	25¼	31
Oregon Short Line 1st 6s	112⅞	100	107
" " " & U. North con. 5s	67¼	48	63
Wis. Central 1st 5s	37½	25	34⅞
Average decline	11.31		
" recovery	4.98		
*2d installment paid.			
†3d " $15 "			
Grangers.			
Chic., Bur. & Q., con., 7s	120	110	115
" " " deb., 5s	99½	85	96½
" " " con., 5s	101⅞	93	96½
" " " Iowa div. 4s	93¾	92	93½
" " " Neb. ext	91½	80	85½
Chic. & East Ill. con. 6s	127	118	122
" " " gen. 5s	101	96½	96½
Grangers.	June 17	Aug. 8.	Oct. 3.
Chic., Mil. & St. Paul gold 7s	129¾	117⅝	123
" " " " con. 7s	132½	119	126
" " " " S. Minn. 6s	118½	110	113¼
" " " " Chic. & Pac. Western 5s	115½	108	111
Chic., Mil. & St. Paul, Chic. & Missouri River 5s	111	102½	105
Chic., Mil. & St. Paul, Wis. & Minn. 5s	112¼	103	106¾
" " " " gen. mtg. 4s	98	91½	94¼
Chic. & North. con. 7s	140	129½	135
" " " sink. 5s	109	104½	109¼
" " " 25 yr. deb. 5s	107	103	104¾
Chic., Rock Island & Pac. ext. 5s	106	94½	100⅛
" " " " deb. 5s	96	89½	91
Chic., St. Paul, Minn. & Omaha con. 6s	126	117	125
Iowa Central 1st 5s	96	87	94¾
Minn. & St. Louis con. 5s	101	96	99
Average decline	8.56		
" recovery	4.38		
Miscel'aneous.	June 17	Aug. 8.	Oct. 3.
Ann Arbor 1st 4s	71⅝	63	69¾
Austin & Northwest 1st 5s	86½	82	82¾
B'way & 7th ave. con 5s	116	109⅝	116
B'klyn Elev. 1st, 6s	85	77	74½
Union Elev. 1st 6's	84	75	72
B'klyn Rapid Tran. 5s	80	70	76
Buff., Roch. & Pitts. gen 5s	99	95	96
Bur., C. R. & North. 1st	106	100	105
Canada South. 1st	110⅞	105	107¾
" " 2ds	106	100	102¼
Ches. & Ohio, con. 6s	108	100	106⅛
" " gen., 4½	75	65	70⅝
" " R. & A. 1st 4s	97¾	90	93½
Col., Hock. Val. & Tol. 6s	88	80	83½
" " " 5s	87	80	84
Central Pacific 1st 6s, 1898	103½	100	99½
Lake Erie & West. 1st 5s	117⅝	110	113
Manhattan Railway, con. 4s	98⅝	88	90¼
Met. Elevated 1st	120¼	111½	118
Mexican Int. 1st 4s	79½	74¾	71½
N. Y., N. H. & Hart., con. dep. 4s	132½	127½	129½
North. Railway of Col. 1st 5s	94½	91½	92¼
Southern Pac. of Cal., con. 5s	92½	87½	86¾
Third Avenue 1st 5s	122½	114	119½
West. N. Y. & Pa., gen. mtg.	44	33	41
Average decline	7.16		
Rally	3.66		

Seventeen railroads of Texas have asked the State Railroad Commission to hear an application from them for leave to increase rates, and the Commission has granted the request, the hearing to be held Oct. 20. The question to be considered ought to be rather simple, for the Commissioners, for with the annual reports of the railroads before them, supplemented by monthly statements of earnings since the end of the last fiscal year, they can readily decide whether the railroads do or do not need greater incomes. After once deciding that they ought to earn more—if they do so decide—the rational course will be to make a horizontal advance in the maximum rates, leaving it to the railroads themselves to make whatever adjustments, within the limit, may be necessary. It cannot be that the railroads, after extended experience with low rates, will advance prices (even where they have permission to do so) sufficiently to check the movement of traffic. But the Commissioners evidently intend to dig deep. Their notice of the hearing takes a column and a half, with a preamble that is a curiosity. Whatever the degree of simplicity in the settlement of the question there is no danger of dullness in the preliminary discussion. After *whereases* innumerable it is announced that the Commission will hold the inquiry as requested; "and will submit for discussion the following inquiries;" and then the notice goes on to name 14 subjects. Among other points the Commission will ask if existing freight rates are just and reasonable; if the railroads are more unfortunate than other classes of business; if interstate rates are reasonable in themselves, and if so whether they operate fairly to Texans; if not fair, in what instances they are unfair. The Commission will require statements of interstate tariffs for the past year, showing proportions accruing to Texas lines; statements of the volume of intrastate and interstate traffic. Inquiry will be made whether the Texas roads have imposed undue burdens upon their Texas lines for the purpose of helping a line somewhere else; to what extent the Southwestern Traffic Association has assumed jurisdiction in Texas [usurping the powers of the Commissioners], and how much good it has done in preventing rate cutting; to what extent it has deprived Texas traffic managers of the free exercise of their judgment in the establishment of interstate rates and in consenting to proposed rates within the state of Texas. Inquiry will then be made into the differences between carload and less than carload rates on freight from places outside the state; whether the railroads have not disregarded their own rules in this matter, and whether there should not be carload rates on a larger variety of articles, with a greater difference between the C. L. and L. C. L. rates; and finally to what extent rebates have been given and what the effect has been. This is the substance of the 24 inches of fine print in which the notice is printed in a Texas newspaper. The attitude of the Commissioners toward the railroads seems to be: "You are great deceivers; we suspect that you are constantly attempting to play tricks on us by juggling rates in such a way that we cannot get at you and punish you for the wrong doing; but we will treat you fairly nevertheless, at least in outward form." It would hardly be fair to say that a perusal of the notice leaves the impression that the Commissioners intend to decree justice, only in case justice is on their side, but their statement of premises and their propositions certainly indicate that they will take care that the burden of proof rests entirely upon the railroads; we judge that it will rest pretty hard.

The New Orleans Freight Bureau, the stockholders of which have just held their third annual meeting, seems to continue to enjoy the confidence of its supporters. The annual report of Mr. Masters, the Commissioner, shows that he has been active in a number of directions, not confining himself to the narrow subject of freight rates. The question of port and dock charges, matters which may seriously affect the export and import traffic through New Orleans, have been the subject of a good deal of discussion during the past year, and the bureau has participated in the work. A bill has been passed by the Legislature looking to an improvement of conditions and reduction of charges, and the track connections of the railroads with wharves and other industries have been improved, largely through the instrumentality of the bureau. The movement to offer country merchants special inducements to come to the city at certain seasons has been continued, and with decided satisfaction to the merchants of the city. With an intelligent sense of the true method of conducting railroad competition, the Freight Bureau has favored the maintenance by the railroads of a traffic association, and such a body has been in existence at New Orleans intermittently, the usual difficulties being encountered there as elsewhere. The last disruption was caused by a disagreement about the payment of cartage charges, one road, whose freight house was unfavorably located, having made such large payments that rates became seriously demoralized. This was nearly a year ago, and the arbitration of the dispute, which was left to a prominent traffic official of New York City, still hangs fire. Mr. Masters speaks favorably of the Southwestern Traffic Association and of the Southeastern Mississippi Valley Freight Rate Committee, but the Southern States Freight Association he regards as hurtful to New Orleans, because its members have so much larger interest in other cities. The sensitiveness of the mercantile interests which railroads have to deal with in these modern days of sharp competition is illustrated by the complaint, in this report, of the treatment accorded New Orleans at the time of the recent war in freight rates from the East; the fact that the reductions to New Orleans were not made until 10 days after those to other cities is brought up as a decided grievance. The bureau has handled during the past year 330 claims against the railroads, of which 51 are still pending. Of the others, 234 have been paid, 19 withdrawn, 15 declined by the bureau, and 11 by the transportation company. In closing, the Commissioner states that his relations with the railroad companies have been for the most part cordial, and he says that they like to deal with a bureau in preference to dealing with individuals not familar with traffic conditions.

The permanent Board of Directors of the new Northern Pacific is a remarkably strong one. Representatives of such varied and immense financial interests are seldom found in one board of railroad directors and it is probably true that the Northern Pacific board represents greater financial interests than any other similar body. Such names as Rockefeller, Coster, Adams, Stillman, Ives, Dumont Clark, D. Willis James and Charlemagne Tower, are the best guarantee that the new company will not lack wise financial direction. The directors represent the interests of the Deutsche Bank, J. P. Morgan & Co., and of several of the strongest banks and trust companies in this country, amply able to protect the finances of the company, if their support is ever needed. The board is not without names of the very highest standing as practical railroad men—Presidents E. B. Thomas and Samuel Spencer, both now the active executives of great railroad properties, besides Mr. Winter, the Northern Pacific's President, Mr. Oakman, formerly President of the Richmond & West Point Terminal, and Mr. Galloway, formerly Vice-President of the Manhattan Elevated. With an able and interested board of directors, a financial structure built on sound and conservative lines, with liabilities carefully estimated to fall within the minimum earning ability of the company, sufficient working capital, and a capable management, the future of the Northern Pacific is most promising.

The strike of telegraph operators on the Canadian Pacific was settled Oct. 9 by the issuance of a notice by the company, taking back, without prejudice, all strikers who had not been guilty of grave misconduct. Employees dismissed for refusing to take the places of strikers were also taken back, where guilty of no other offense. The newspaper accounts state that the strikers, who made a complaint to the Vice-President when they should have gone to their respective Division Superintendents, are now to be permitted to go directly to the General Superintendents. This would seem to be somewhat of a compromise, but the official announcement has nothing to say on this point; it indicates that the only concession made by the company was to turn out the new men who had been engaged. The settlement was brought about by a committee of four men who, it appears, represented the four principal employees' brotherhoods on the road. Reports as to the actual delay to trains in consequence of the strike are contradictory, but we judge that the trouble was not very serious.

Present Status of the Distribution and Transmission of Electric Energy.

(*Concluded from page* 721.)

tion that does not require to be started from rest by some outside means. This prevents a single-phase current from being used at the present time for power distribution; and as in most transmission the distribution of

power is an important item, single-phase currents are not suitable for this purpose. In a two-phase system the currents are usually carried on a separate pairs of wires, while in the three-phase system, three wires are generally used, a common return being unnecessary, as the sum of the currents is zero, unless the circuits are unbalanced. In distributing on the three-phase system, a fourth wire can be employed, as it gives an advantage in the amount of copper used.

In all these alternating systems, the great difficulty lies in the fact that the inductance of the circuit causes the current to lag behind the electromotive force. This decreases the amount of energy transmitted by a given current at a given voltage; it causes a drop in the voltage of the line, and it increases the armature re-action of the dynamo for a given current. The total inductance of the circuit is made up of the inductance of the transformers, of the dynamos, of the receiving apparatus and of the line. In the case of transmission to very long distances the line inductance is a large proportion of the total, while the induction of the receiving apparatus depends upon whether lights or motors are to be supplied, and upon the construction of the latter. When the different wires of the multiphase system are fed from windings on the same dynamo armature, then the drop in voltage due to any excess of load on one of these circuits cannot be compensated for on the dynamo itself. If the amount of current and the lag of the current is the same for all of the circuits of the system, then it is easy by a compounding winding of the dynamo, or by changing the current in the field winding, if there is no compounding, to keep the voltage constant at either the sending or receiving end. When the load on the different wires of the system is not the same, however, it is, as I have stated, impossible to keep all of the circuits at the proper voltage. Where a two-phase transmission with separate circuits is used, then if the separate circuits are wound on different armatures, each can be regulated to give a constant voltage at the receiving end. This is the case, for instance, in the large dynamos built by the Westinghouse Company for use at the World's Fair in Chicago. The difficulty due to the uneven loading of the circuits is specially marked in the case of the three-phase system, and it is one of the principal objections that have been urged against the employment of this system for distribution. It should be pointed out, too, that it is not enough to balance the quantities of current for the three branches of the system, but the character of the current must also be considered. A non-inductive load on one wire, with an inductive load of equal value on the others, would cause an unbalancing just as if the currents differed in amount. In most of the transmission plants that are being operated and that are proposed it is required to run both lamps and motors from the same circuits, and while a slight variation of potential on the motors would not cause any particular trouble, yet the successful operation of the lamps requires a practically constant voltage. I think, however, and the same gounds have been taken by others, that in any practical transmission of considerable size, it is possible to so balance the loads that this difficulty will not exist to any extent to cause any serious trouble. When the distributing part of the lines is reached it is usually the custom when a three-phase transmission is used to employ four instead of three wires. As for line inductance in the two-phase and three-phase systems, there is no question that the latter has an advantage in this respect. By suitable arrangement of circuits the line inductance can be brought to a minimum, and this is of the utmost importance in long-distance transmission. I will not take into account the supposed increased efficiency of three-phase motors and dynamos as against two-phase apparatus, as there is a question as to whether a superiority exists, but simply considering the decreased amount of copper required and the decreased inductance of the line, there is no question, in my mind, that, for transmission, the three-phase system is superior to the two-phase. It is well known, of course, that the inductance of the circuit can be, in some measure, compensated for by the use of condensers or over-excited synchronous motors. The first of these remedies is, however, a very uncertain quantity commercially, while the second should be used as much as possible; that is, as many synchronous motors should be connected as is practicable. The best remedy, as things stand at present, lies in the careful construction of the line and the apparatus, so that the effects, although they exist, can be reduced to a minimum.

It has been shown by Mr. Scott and others that it is possible to transform a two-phase into a three-phase current, to transmit it and to transform it back again to a two-phase current. This will allow us, if we wish, to use two-phase dynamos for generating the current, to transmit with the advantage incidental to the use of three-phases, and at our reducing end to use two-phase circuits for transmission. This has some advantages as far as balancing the voltage on the circuits go, and it has been proposed in the case of several plants whose installation is being considered.

Looking broadly at the value of alternating transmission as against continuous-current transmission, we have a gain in the simplicity and safety in the transmission, and at the distributing end the use of multiphase currents enables us to supply both lamps and power with an economy and success comparable to that of the continuous-current system. If it is necessary to use continuous currents for certain types of distribution at the receiving end, they can be obtained by the use of rotary transformers, by which the alternating current is transformed into a continuous-current. These machines have approximately the efficiency of corresponding continuous-current dynamos, while the output for a given size is about 50 per cent. greater.

Possible Voltages and Distances of Transmission.

A number of calculations have been made as to the possibility of transmitting electrical energy to very long distances. If the question of cost of transmission alone is considered, then where water powers or culm heaps are within distances of 100 miles of some large center of consumption, it has been shown that it would be profitable to generate and transmit electrical energy. In these calculations, however, voltages are assumed that have never been employed for commercial plants, and whose availability is problematic, while sufficient stress is not apparently laid on the question of the reliability of the power. If the industries of a large city depended upon a single transmission plant, it is evident that the question of reliability is of paramount importance. Where energy is supplied to manufacturers, to street-car systems, and for lighting, a break-down that would involve the cutting off of current for a day would mean an enormous pecuniary loss to the community. As the distance of transmission increases, the possibility of accident is increased in greater ratio, because we have not only the higher voltages to control, but the length of the line that must be looked out for is also increased. The best guide lies in the practical experience which has been obtained in the present transmission plants and the consideration of the difficulties that have arisen and the remedies that have been employed. I have prepared a partial list of the principal transmission plants that are now in operation.

LONG-DISTANCE TRANSMISSION PLANTS.

Name.	Type.	Distance in miles.	Line volt'g.	Horse power.
Ouray, Col.	Direct	4	800	1,200
Geneva, Switzerland.	"	20	6,600	400
San Francisco, Cal.	"	12	8,000	1,000
Brescia.	"	12	15,000	700
Pomona & San Bernardino.	Single phase Alt.	13¼ to 28¾	1,000	800
Telluride, Col.	"	3	3,000	400
Bodie, Col.	"	12½	3,400	160
Rome, Italy	"	18	6,000	2,000
Davos, Switzerland.	"	2	3,660	600
Schongeisung, Germany.	"	4½	2,600	820
Springfield, Mass.	2-phase Alt.	6½	3,600	820
Quebec, Canada.	"	8	5,000	2,130
Anderson, S. C.	"	8	5,500	200
Fitchburg, Mass.	"	2¼	2,150	400
Winooski, Vt.	3-phase.	2½	2,500	150
Baltic, Conn.	"	5	2,500	700
St. Hyacinthe, Canada.	"	5	2,500	600
Concord, N. H.	"	4	2,500	5,000
Fresno, Cal.	"	35	11,000	1,400
Big Cottonwood to Salt Lake City, Utah.	"	14	10,000	1,400
Lowell, Mass.	"	6 to 15	5,500	480
Sacramento-Folsom, Cal.	"	24	10,000	4,000
Redlands, Cal.	"	7½	2,500	700
Lauffen to Frankfort, Germany	"	100	30,000	300
Lauffen to Heilbronn.	"	9	5,000	600
Oerlikon Works, Zurich, Switzerland.	"	15½	13,000	450
Portland, Or.	"	12	6,000	5,000
Silverton Mine, Col.	"	4	2,500	400

[Nearly all of the above roads are in successful operation. The road from Lauffen to Frankfort, Germany, is in an experimental state. The San Francisco road has been in operation for nine years, and the Pomona & San Bernardino road for four years, and is being increased. The plants located at Ouray, Col.; Fresno, Col.; Redlands, Cal., and Silverton Mine, Col., are also to be increased.]

It will be seen that the longest transmission is at Fresno, Cal., the distance being about 35 miles. The highest alternating voltage used is 13,000 volts at Zurich, Switzerland. The highest direct potential is 15,000 volts at Brescia. No limit of either distance or potential has as yet been reached. If we consider the record of the present transmission plants, we can safely say that it would not be going outside of the safe limit of development to transmit at least 50 miles at a potential of 20,000 volts, provided the energy could be delivered at such a price as to be considerably lower than the cost of a corresponding amount of energy obtained from a steam plant. This, of course, is a matter of local condition entirely, and the commercial value of such a transmission will depend upon local conditions.

Long-Distance Transmission for Railroad Work.

The possibility of long-distance electric-railroad lines is intimately connected with the possibility of long-distance transmission of power. We have seen that it is possible to transmit considerable distances from a single station. The current so distributed is not, however, such that it can be applied directly to railroad motors, but it must be transformed at points along the line, the distance apart of these points of distribution depending upon the system that is employed. At present continuous-current motors are used, and considerations of safety would lead us to use line potentials not greater than 700 volts. By distributing rotary transformers at distances of five or six miles apart, we would be able to supply motors with current without any great investment in copper. The amount of copper required could be still further reduced by using rotary transformers with storage batteries, thus keeping a constant load on the transmission line. It will be found, however, that on any long-distance railroad line the load on any section of the line is exceedingly variable, and the discharge rate of the batteries will have to be very high in order to prevent excessive cost for our reducing stations. It is doubtful whether we have reached a point in battery construction where this system of transmission would be economical. It is certain, however, that when the distances are comparatively short, say within 15 miles, and where the traffic is not evenly distributed, that rotary transformers, with or without batteries, can be economically employed for railroad work.

Conclusions.

My conclusions, subject always to the influence of local conditions, are as follows:

1. In both direct-current lighting and traction systems, where the power is generated in or near the area of distribution, it is best to use one station situated at the most economical point for producing power.

2. In the case of the traction systems, when the economical area of direct distribution is passed, boosters should be employed directly or in connection with batteries, to a distance of 10 or 12 miles from a station, and beyond this rotary transformers, whether with or without batteries, should be used.

3. In the case of direct-current lighting systems, the energy should be transmitted to storage batteries situated at centers of consumption either directly or by means of a rotary transformer and distributed from them.

4. Where batteries are used it is best to place them at the end of feeder wires to obtain the advantage of a constant load on the wire.

5. The best system for the long-distance transmission of energy, for general purposes, is the three-phase alternating system.

6. Commercial transmissions are in successful operation for distances of 35 miles, and for voltages as high as 15,000 volts.

Experience with these plants shows that the transmission to 50 miles with a pressure of 20,000 volts is practicable; beyond these limits the transmission would be more or less experimental.

Car Heating by Steam.

At the meeting of the New York Railroad Club held this week, Mr. Robert M. Dixon, Engineer of the Safety Car Heating and Lighting Company, read a paper with the above title. It was chiefly designed to bring out discussion and was a statement of what Mr. Dixon conceives should be standard practice in details. We print now only his conclusions:

Rules for Making up Trains.—When a train is made up all steam hose should be coupled and all the cocks in the steam train pipe the whole length of the train should be opened.

When signal is given steam should be turned on at the cab, not to exceed 65 lbs., and allowed to blow through the entire length of the steam train pipe.

After steam issues at the rear end of the train pipe the rear cock of last car should be closed and reducing valve in cab set to 40 lbs. pressure. If more than eight cars are in the train add 5 lbs, for each additional car. In very cold weather the rear train-pipe cock should be left open enough to allow a little steam to pass and escape through the rear coupling.

Regulation of Temperature.—To heat cars, open steam inlet valves on each car; and when live steam appears at the drips, set each drip so that a little steam escapes with the water. If a trap be used, see that it is adjusted to allow a little steam to escape with the water.

Frequently examine traps and drip valves to see that they are operating properly. They should be as hot as can be borne by the hand. If cooler, or cold, they should be opened a trifle; or if too hot, or steam is blowing, closed a little.

Never close steam inlet valves entirely without first opening drip valves or blow-off valve, and allow water to blow out before closing steam inlet valve.

When steam is required on this car again, open steam inlet valve, and afterward close drip valves or blow-off valve.

Changing Engines.—When approaching stations where engines are to be changed, or terminals where cars are to be laid up, five minutes before arriving at such stations the rear train-pipe cock must be opened wide, and before coming to a stop at such stations the engineer must shut off steam at boiler valve. Do not use reducing valve for this purpose.

If engines are to be changed, trainmen must satisfy themselves that steam is shut off at engine before uncoupling cars.

In freezing weather, if cars are to be laid up, or stand 30 minutes after engine is uncoupled, the hose throughout the train must be uncoupled, and all drip-valves or blow-off valves opened.

The greatest expense of maintenance of steam equipment is the renewal of the coupling hose. The following set of specifications and rules for testing are reasonable, and have been found to give good results; At least one per cent. of each lot of steam hose should be tested:

Samples selected at random from each invoice must deflect 5 in. for each 24 in. length, for a pull of not more than that shown in the following table:

Steam at 45 lbs. to 60 lbs. pressure to be on hose 10 hours and off 14 hours of each day.

MAXIMUM ALLOWABLE PULL TO DEFLECT 5 IN.

	Before test.		During test of two weeks.	
	Cold.	Hot.	Cold.	Hot.
1¼ in. hose.	45 oz.	35 oz.	55 oz.	45 oz.
1½ in. hose.	60 oz.	50 oz.	75 or.	70 oz.

After test the tube and friction must be in good condition, and the hose must not have increased in outside diameter more than 10 per cent.

All hose to be smooth, uniform and well finished.

TECHNICAL.

Manufacturing and Business.

Interlocking rubber tiling has recently been ordered for 32 dining and sleeping cars, one steamship, one United States battleship and three prominents hotels in New York City. The New York Belting & Packing Co., the maker of this tiling, informs us that it has been necessary to work nights to fill orders. The interlocking tiling laid in the Broad Street Station of the Pennsylvania road at Philadelphia, 2¼ years ago, has had very hard usage constantly since, but has worn only $\frac{1}{16}$ of an inch, and that only in spots where the most constant travel over it is concentrated.

The Cleveland Frog & Crossing Co. has moved into a new iron building, 100 ft. × 170 ft. All the machinery and tools have been removed from the old buildings.

The Tyler Car & Lumber Co., of Tyler, Texas, at the instance of the Paramore Investment Co., has been placed in the hands of a receiver, the application being in the shape of a suit for a bill of $39,000. The receiver is J. J. Carter, Superintendent of the Company's mill at Mitchell, Tex.

The corporation of E. S. Greeley & Co., dealers in electrical and railroad supplies, New York City, has been placed in the hands of a receiver. Business has been done at a loss since 1893. The capital stock of the company as named in the articles of incorporation is $250,000; the liabilities are $160,000 and the assets $180,100.

Iron and Steel.

The Pennsylvania Steel Co. has secured a contract from the Central Passenger Railway Co., of Baltimore, Md., for 2,000 tons of 86-lb. rails, for the extension of the road in East Baltimore. The furnaces of the Pennsylvania Co., at Steelton, Pa., have been blown in, and work on the order will be begun immediately.

The works of the Illinois Steel Co., at Joliet, Ill., were closed on Oct. 9, throwing about 3,000 men out of employment. It is expected that the shut-down will be only temporary.

The 30 puddling furnaces of the Wheeling Iron & Steel Co., at Wheeling, W. Va., resumed operation recently, after an idleness of two months, giving employment to a full force of men.

The tests of the Hawkins steel-making process at the plant of the Jefferson Steel Co., Birmingham, Ala., have finally been successful, a satisfactory soft steel having been made from the basic iron produced from Alabama ore. Specimens of the steel are shortly to be taken north for analysis there by experts.

The Blandon Rolling Mill, at Reading, Pa., resumed operations on Oct. 5, after an idleness of five weeks. The plant will be run on double turn for the present, and 175 men will be employed.

The Carnegie Steel Co. is adding four new blast furnaces to its Duquesne plant, at Cochran, Pa. Two of

the furnaces have already been blown in, the second on Oct. 7. It is expected that Nos. 3 and 4 will be finished in two months. A new mixer house is also being built. Additional storage capacity will be provided, to meet the needs of these new additions.

A meeting of the puddlers of the Ellis & Lessig Steel & Iron Co. was held at Pottstown, Pa., on Oct. 5, and it was decided not to accept the company's offer of $2.15 a ton. This rate prevailed in the mills from April 1, 1894, to July 1, 1895, and then the rate was raised to $2.75. The mills have been idle for some time, and it was the intention of the company to resume at the former rate.

The Scranton Steel Works of the Lackawanna Iron Co., which have been idle for three months, resumed operations in all departments on Oct. 12, giving employment to 1,200 men.

New Stations and Shops.

The engine house, depot and other property of the Southern Railway at Woodstock, Va., were destroyed by fire last week, together with one locomotive and several freight cars. The buildings will be rebuilt at once, it is stated.

The Northern Pacific has purchased a site for a passenger station in Seattle, Wash., at a cost of $167,000.

An Accident to the Paris.

On Thursday, Oct. 8, when about 320 miles from Sandy Hook, on the eastern trip to Southampton, the starboard tube shaft of the American Line steamship Paris was broken. No other injury was done, and the Paris proceeded on her way to Southampton under the port engine only. Shortly after the accident the Paris was passed by the Hamburg-American liner Fuerst Bismarck, which brought the report of the accident to New York.

Contracts for Naval Gun Forgings.

Secretary Herbert awarded contracts on Oct. 10 for the naval gun forgings, the bids for which were opened last August. The Bethlehem Iron Co. will have 50 sets of 6-in. at 23 7/10 cents per pound, 20 sets of 4-in. at 26½ cents per pound, and two sets of 8-in. at 23¾ cents per pound. The Midvale Steel Co. will have 35 sets of 5-in. at 26 cents per pound. In each case the work was given to the lowest bidder.

River Notes.

The contract for continuing the work of dredging a channel 7 ft. deep at mean low water and 60 ft. wide, in Smyrna River, Delaware, has just been completed by Messrs. Haupt & Franklin, contractors, of Philadelphia. About 12,000 cu. yds. of sand, gravel and mud, some of it very hard, were taken from the channel and placed on shore beyond high-water mark.

At noon, Oct. 8, bids were opened by Gen. Wm. F. Smith, U. S. A., for dredging, removing snags, and wrecks and opening up a channel 3 ft. deep and 25 ft. wide from Churchman's Bridge to Smalley's Bridge on the Upper Christiana, Del., as follows: The Atlas Dredging Co., Wilmington, 23 cents: The Virginia Dredging Co., Richmond, 24 cents; The American Dredging Co., Philadelphia, 26 cents; Haupt & Franklin, 28½ cents. Work to be completed on or before Dec. 31, 1896.

American Institute Fair.

The sixty-fifth fair of the American Institute is now being held at Madison Square Garden, New York City. The main floor of the building is occupied largely by miscellaneous trades, but the entire basement has been set apart for exhibits of mechanical devices and is known as "Machinery Hall." Among the exhibits likely to be of interest to our readers are the following:

James Brandon, 390 Eleventh avenue, New York City.—Patent balanced cylinder packing ring.

C & C Electric Co., 143 Liberty street, New York City.—An 8 K. W. dynamo receiving power from a 12-H. P. engine of the Otto Gas Engine Co. Is equipped with the Newall Para pneumatic pulley.

Dodge Manufacturing Co., Mishawaka, Ind.—Wood split pulleys and split friction-clutch pulleys and couplings, also hangers and other devices used for transmission of power. The company also supplied all the shafting used in operating the machinery.

Hartig Standard Gas Engine Co., 39 Dey street, New York City.—The Hartig patent gas engine.

R. T. Kanski, 704 East 137th street, New York City.—Patent railroad signal.

Kerr & Co., 304 Broadway, New York City.—The company exhibits Kerr's improved lacing, which is on the belts used to connect the working exhibits with the main shaft.

The Law Co., 121 Liberty street, New York City—Corundum and emery wheels and grinding and polishing machinery. The company also shows in operation a special automatic grinding machine adapted especially for grinding tools of a planer and the guide bar of locomotives.

New Jersey Blower Co., Newark, N. J.—Pressure blowers and exhausters for heating and ventilating.

Otto Gas Engine Works, Philadelphia, Pa., represented by the New York selling agents, A. C. Manning & Co., 18 Vesey street.—The exhibit shows in operation a 40-H. P. and a 12-H. P. (actual) gas engine, and 2-H. P. and 25-H. P. marine engines; also 9-H. P. and 5-H. P. stationary gas engines, and 4-H. P. and 50-H. P. marine engines.

Watson & Stillman Co., 204 East Forty-third street, New York City.—This exhibit occupies about 800 sq. ft. and includes a complete line of hydraulic presses, pumps, punches and shears, valves and fittings and other hydraulic tools and supplies, together with a number of specimens of work done by hydraulic machinery.

The power used to operate the mechanical exhibits is supplied by a Weston "Imperial" 100-H. P. engine, with cylinders 12 × 12 in., manufactured by the Weston Engine Co., of Painted Post, N. Y. The belting was supplied by the Brooklyn Leather Belting Co., of Brooklyn, N. Y.

H. W. Johns Manufacturing Co., 87 Maiden Lane, New York City.—A very complete exhibit, occupying about 500 sq. ft., of asbestos and vulcabeston goods and electrical materials, including the "H. W. J." electric car heater, described in our issue of Aug. 14. The asbestos goods include roofing and fireproof construction materials, boiler and pipe coverings, steam packings, asbestos fabrics, rope, cord and twine and fireproof cements. Also paints, colors and stains for railroad use and overhead line materials for trolley electric roads.

Riker Electric Motor Co., Brooklyn, N. Y.—Horseless carriage using electricity as a motive power.

All the mechanical features of the exhibition are not confined to the basement, however, the following being in position on the main floor:

W. L. Chase, 112 Liberty street, New York City.—Hot-air pumping and power-engine.

Daimler Motor Co., Steinway, L. I. City, N. Y.—Two-H. P. stationary gas motor, 1-H. P. stationary gosoline motor, 4-H. P. stationary kerosene motor, 20-H.P. marine motor: inspection car for railroads, operated by the Daimler motor; three horseless carriages, including the types referred to in our last issue as having been awarded prizes in the road competition in France, together with a fire engine and boat operated by the Daimler motor.

Gold Car Heating Co., Frankfort and Cliff streets, New York City.—Steam heating equipment for railroad cars, including valves, traps, couplings and duplex double coils, and the Gold electric heater for street railroad cars, houses and buildings.

Principles of Foundation Building.

The *Journal of the Association of Engineering Societies*, for July, contains an article on the "Principles Governing the Design of Foundations for Tall Buildings," by Mr. Randell Hunt. In his paper, Mr. Hunt treats more particularly of the principles to govern foundation work where yielding and uncertain soils are encountered. The advantages and drawbacks of the method of independent piers, of concrete and steel beam, and of pile foundations are touched upon, with instances where they have failed, and where they have served well. Some stress is laid upon the investigation of ground pressures in cases where the top layer of soil overlies a softer one. In this regard, the author states that experiments seem to indicate that the angle, which the direction of pressures through the ground makes with the vertical, is only about one-half the natural angle of repose, instead of the whole angle, as was at one time generally supposed. As the angle of repose for ordinary moist sand is about 40 deg. this makes the angle of pressures inclined 20 deg. from the vertical, and the same angle for water-saturated sand only 12 deg. Considerable space is given to the effects of earthquake vibrations on buildings, and the design of foundations to avoid these. The conclusion is reached that shallow foundations are not best adapted to avoid the vibrations, since it has been determined that there is less vibration at some feet down in the ground than on the surface. Independent piers are not good either, because the intensity of vibration often varies considerably within a very limited space. In conclusion, the main thing is to know the exact nature of the soil upon which the structure is to be built. All others are secondary to this. The investigation of the soil must be complete for considerable depths. The loading must be within the limits of such pressures as produce known amounts of settling.

THE SCRAP HEAP.

Notes.

The Manhattan Elevated Railroad, New York City, is introducing turnstiles at some of the stations where the number of passengers entering trains is not large. Hitherto every gate has been manned by an attendant day and night.

Several years ago the North Carolina Railroad Commission made the rates for express charges on the Atlantic & North Carolina road (operating between Newberne and Morehead, 102 miles) higher than that allowed on the large roads. Last week the commission, against the protest of the railroads and express companies, ordered the rate on the A. & N. C. reduced to the standard, a reduction of from 33 to 50 per cent.

The two-score persons injured and the heirs of the two killed in the collision on the New York & Sea Beach Railroad in September, 1895, have finally been obliged to give up all hope of getting any compensation from the railroad company. The corporation was, we believe, practically insolvent at the time the accident occurred, and a recent decision of the Appellate Division of the New York Supreme Court holds that the lien of the bondholders will absorb the whole of the property.

Lake Notes.

The Bessemer Steamship Co., the last of whose 16 steel vessels are now being launched, is in the market for a 4,000-ton barge to tow behind one of its steamers. This order, and one ship under contract, are the only steel freight vessels in sight for Winter work at all lake yards.

The total amount of iron ore carried down the lakes so far this season amounts to about 8,350,000 gross tons, and the shipments for September were 1,200,000 tons, despite most gloomy predictions. For October they will be far less, and the year's total is likely to be about 9,000,000 tons. About half the lake shipping is now laid up for winter.

The Oliver mine, Mesaba Range, Minnesota, has closed its season's work with the greatest total shipment ever made by a mine in America, except one. It shipped 810,000 gross tons and the Norrie group, on the Gogebic, in 1892 shipped more. The Oliver began mining work April 17 and has been mining and shipping 145 days, averaging 5,550 tons daily, but the Norrie mined the entire year. The Oliver is owned by the Carnegie and Oliver Steel Co. interests and shipped exclusively to those companies. Its cost of mining is less than has ever been achieved before, the actual mining being figured at less than 5 cents a ton on board cars. The amount of ore to be mined at this cost cannot be exhausted for many years. The Oliver has proved the most remarkable mine in the world since its accidental discovery in the fall of 1892.

The lumber market at lake ports has undergone a great change in the past 10 days and there is a very considerable movement from all ports. At Marinette one day last week there were 23 vessels loading with a capacity for over 10 millions of feet, and at Duluth some five millions were sold in about the same time. This movement is imperatively demanded if the millers are to operate at all extensively in the lumber woods the coming winter.

Disastrous Boiler Explosion at Danville, Pa.

By the explosion of the boiler in a rolling mill at Danville Pa., on Oct 8, five men and an infant were killed and 20 persons were injured, some of them fatally. A number of the victims were in a dwelling house near by, which was wrecked by fragments of the boiler. The owner of the mill, according to one account, is the Philadelphia & Reading Railroad; another calls it the Montour Iron Works.

LOCOMOTIVE BUILDING.

The 10 new ten-wheel locomotives ordered by the Lake Shore & Michigan Southern from the Schenectady Locomotive Works early in September will all be delivered in about six weeks.

The Pittsburgh Locomotive & Car Works is building five narrow-gage locomotives for Japan, similar to two shipped there in September. They are from designs prepared by Japanese engineers.

The Brooks Locomotive Works, Dunkirk, N. Y., have shipped to the Illinois Central four switching engines with cylinders 18 in. × 24 in. The Illinois Central is having 8 heavy 8-wheel passenger engines built at the Brooks Works. These engines will have driving wheels 6 ft. 3 in. in diameter. The first of an order of several six-coupled engines for a railroad in Japan of 42 in. gage has recently been completed at the Brooks works.

CAR BUILDING.

The Union Traction Co., of Philadelphia, is constructing 14 mail cars for service on its lines. They are about two-thirds of the length of the ordinary street car.

BRIDGE BUILDING.

Baltimore, Md.—The Baltimore & Ohio has let a contract to the Pennsylvania Steel Co. for a railroad bridge over the Little Seneca River in Montgomery County, Maryland. The bridge will be 4,000 ft. long.

Bloomsburg, Pa.—The County Commissioners are taking the preliminary steps to have the Catawissa bridge rebuilt by the state under the provisions of the law enacted in 1895, and the court has appointed viewers. The new bridge will cost between $45,000 and $50,000.

Chicago, Ill.—On Oct. 1, the Board of Trustees of the Sanitary District of Chicago awarded the contract for the superstructure of the Elgin, Joliet & Eastern's bridge to the Milwaukee (Wis.) Bridge and Iron Co., for $33,477; and also the contract for the metal work of the Southwestern Boulevard bridge to the same company, at their bid of $15,200.

Columbia, Pa.—The Western Maryland contemplates extending its line from York to connect with the Reading Branch Railroad, and it is proposed to bridge the Susquehanna at a point a mile west of here called Furnace Hill.

Duquesne, Pa.—Surveyors are running lines for the Duquesne approach of the proposed bridge over which the Pittsburgh & Butler will run to the Duquesne works of the Carnegie company, across the Monongahela at the lower end of this town.

Frazee, Minn.—The Northern Pacific is preparing to put in an iron bridge across Otter Tail River near here.

Harrisburg, Pa.—A charter has been granted to the Ben Avon Bridge Co., which proposes to cross Spruce Run and the wide gulley through which it flows with the new bridge which will form a direct connecting link between Ben Avon and Avalon. The new structure will be 200 ft. high, about 450 ft. in length, and will cost $30,000. F. J. Torrance, of Allegheny, is at the head of the enterprise as President.

Jersey City, N. J.—The Board of Freeholders has decided to build the proposed bridge over the Morris Canal at Pacific street.

Laingsburg, Mich.—It is reported that it has been decided to rebuild a bridge at this place, at a cost of $1,250.

Newark, N. J.—The bids, opened Sept. 30, for the steel work of the main span and the substructure of the Passaic River bridge between Jackson street, this city, and Fourth street, Harrison, were: For superstructure—Boston Bridge Co., $93,990; M. T. Connolly, $81,576; Edge Moor Bridge Co., $94,950; Fagin Iron Works, $78,144; Millard & Lahey, $97,000; F. C. O'Reilly, $88,610; Youngstown Bridge Co., $100,300. For substructure: M. T. Connolly, $115,800; Delaware Construction Co., $65,800; Fagin Iron Works, $115,700; Holmes & Coogan, $73,000; F. C. O'Reilly, $88,447; F. H. Riddle, $64,000; P. S. Ross, $74,250; Sandford & Skillman, $61,975; Alexander Sparks, $68,762; Woodfred & Sillery, $70,227.

Norfolk, Va.—The city will soon build an iron and steel bridge across the creek dividing York street extended in the suburbs of the city. C. B. Johnston is chairman of the Board of Commissioners.

Reading, Pa.—The County Commissioners have been petitioned to build a bridge over the North Kill one mile from Bernville.

Shelbyville, Ill.—Reports state that a steel bridge, about 1,400 ft. long, is to be built over the Kaskaskia River.

Springfield, Mass.—The Springfield & Southwestern Street Railway Company, spoken of in the *Railroad Gazette* last week, proposes to build an independent bridge across the Connecticut River, and an officer of the company states to a local reporter that the plans for the bridge are already drawn. He expects favorable action by the towns interested, and possibly some assistance in building the bridge, as the principal highway bridge now in use is a wooden structure and very old.

Steelton, Pa.—Contracts have been awarded to the Pennsylvania Steel Co., this place, for new iron bridges at the following points on the Central Railroad of New Jersey: Overhead highway bridge at Tyrrell Road, near Fanwood, N. J.; over Rockaway River, at Dover, N. J.; over Highway, near Lebanon, N. J.; over Pohemus Creek, near Bound Brook. They will cost $10,000.

Tiffin, O.—The Pennsylvania and the Baltimore & Ohio will unite in building a viaduct for elevated tracks at this place.

New York.—After legal complications lasting over nine years the Board of Street Opening has passed a resolution authorizing Commissioner Haffen to build a viaduct at 153d street over the New York Central tracks.

On Wednesday, Oct. 7, the new East River Bridge Commissioner opened the following bids for the construction of the New York tower foundations:

NEW EAST RIVER BRIDGE—BIDS FOR THE NEW YORK TOWER FOUNDATION.

Name of bidder.	All granite.				Granite and Limestone.			
	Lump sum to datum plane.	Completed work below datum plane 950 cu. yds.		Total bid on engineer's plans.	Lump sum to datum plane.	Completed work below datum plane 950 cu. yds.		Total bid on engineer's plans.
		Per cubic yard.	Amount.			Per cubic yard.	Amount.	
1 Patrick H. Flynn	410,000	$17.00	16,150	426,150	367,600	$17 00	16,150	383.150
2 Arthur McMullin & Co	439.000	35.00	33,250	472.2 0	424,000	35.00	33,250	457 259
3 Union Bridge Co	460,0 0	30.00	28,500	488,500	455,0 0	30.00	28,500	483,500
4 John B. Westbrook	456,187	25.00	23,750	479 937	399,875	25 00	23,750	423,625
5 Tullock & Noble	456,000	27.00	25,650	481 650				
6 McLeon Johnson & Bailie Const. Co	470,000	25.00	23,750	493,750	460,000	25.00	23,750	483,750
7 Union Bridge Co (Steel Caisson)	467,000	30.00	28,500	495,500	462,000	30.00	28,500	490,500
8 Bernard Naughton	473,280	33.00	31,350	504,630	441,032	33.00	31,350	472 382
9 Sooysmith & Co	499,795	29.00	27,550	527,345	470,800	29.00	27,550	498,350
16 Hart and Anderson	499,000	37.00	35,150	534,150	445,000	37.00	35,150	480 150
11 John Pierce	549.000	28.00	26,600	575,600	449,000	28.00	26,600	475,600
12 E. J. McKeever & Bro	594,000	39.60	37,620	631,620	566,000	39.60	37,620	603,620

Warren, Pa.—Council has authorized the Bridge Commissioners to draw up a contract with the water company, street railroad company and borough for building a new bridge over the race. The borough will bear one-third of the cost, the railroad company one-fourth, and the water company five-twelfths.

Wilkes-Barre, Pa.—Pond Creek, in Luzerne County is crossed by the Sandy Run Branch of the Central Railroad of New Jersey by a wooden trestle, 600 ft. long. The trestle, which is worn out, also crosses a highway. Instead of renewing the woodwork, arch culverts will be built for highway and waterway, balance of space to be filled in with earth. About 20,000 cu. yds. earth fill will be required and 800 cu. yds. of masonry.

Winston, N. C.—The city authorities and the Northwestern North Carolina will jointly build a bridge and some iron trestle work.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Central of New Jersey, quarterly, 1¼ per cent., payable Nov. 2.

Cincinnati, Sandusky & Cleveland, semi-annual, 3 per cent. on preferred stock, payable Nov. 2.

Lake Erie & Western, quarterly, 1¼ per cent. on preferred stock, payable Nov. 14

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Alabama & Vicksburg, annual, Jackson, Miss ,Nov. 2.
Baltimore & Cumberland Valley, Baltimore, Oct. 21.
Bangor & Aroostook, annual, Bangor, Me., Oct. 20.
Chesapeake & Ohio, Richmond, Va., Oct. 20.
Cleveland, Cincinnati, Chicago & St. Louis, annual, Cincinnati, O., Oct. 28.
Chicago Junction Railways and Union Stock-Yards Co., annual, Jersey City, Nov. 12.
Danbury & Norwalk, annual, Consolidated Railroad Company's building, New Haven, Oct. 29.
Georgia Southern & Florida, annual, Macon, Ga. Oct. 21.
Illinois Central, annual, Chicago, Ill., Oct 21.
Maine Central, annual, Portland, Me., Oct. 21.
New England, annual, Hartford, Conn , Oct. 22.
New Orleans & Northeastern, annual, New Orleans, Nov. 4.
Northern Pacific, annual, New York, N. Y., Oct. 15.
Pittsburgh & Western, annual, Allegheny City, Pa., Oct. 19.
Rio Grande Western, annual, Salt Lake City, Utah, Oct. 25.
St. Louis, Alton & Terre Haute, annual, St. Louis Mo., Oct. 21.
St. Louis & San Francisco, annual, St. Louis, Mo., Oct. 27.
Southern, annual, Richmond, Va., Oct. 20.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Street Railway Association* will hold its annual convention at St. Louis, Oct. 20 to 23. For programme see issue of Sept. 18, page 660.

The *Engineers' Club of Philadelphia* will hold its next business meeting on Oct. 30.

The *American Institute of Electrical Engineers* will hold its next meeting at No. 12 West Twenty-first street, New York, on Oct. 21.

The *Association of Railway Superintendents of Bridges and Buildings* will hold its annual meeting at Chicago on Oct. 20. For programme see issue of Aug. 7, page 560.

The *Society of Naval Architects and Marine Engineers* will hold its third general meeting at No 12 West Thirty-first street, New York City, on Nov. 12-13.

American Street Railway Association.

The special train over the New York Central to the Street Railway Convention, St. Louis, will leave on Saturday, Oct. 17, at 1 p. m., instead of Sunday, as before announced. This change is made to accommodate a large number who desire to be in St. Louis on Monday, the Convention beginning on Tuesday, Oct. 20. The train will depart from Grand Central Station, Forty-second street, 1 p. m., Saturday, arriving at St. Louis 6:56 p. m. Sunday.

The Civil Engineers' Club of Cleveland.

At the regular meeting, held in the rooms of the club, Case Library Building, Oct. 13, resolutions upon the death of J. F. Holloway and of Dr. C. O. Arey, were adopted. Mr. J. D. Varney presented a paper upon "Solar Work in Land Surveying."

Freight Claim Association.

This association held a regular meeting in Richmond, Va., last week, the sessions lasting three days. The rules for dealing with claims for losses, damage and overcharges were discussed, and some changes agreed upon. The next meeting will be held in Nashville, Tenn., May 5, 1897.

American Institute of Electrical Engineers.

The next meeting of the institute will be held at 12 West Thirty-first street on Wednesday evening, Oct. 21, and will be devoted to a topical discussion on the subject of "Electric Traction Under Steam Railway Conditions." The discussion will be opened by Dr. Charles E. Emery, and prominent steam engineers as well as electrical engineers have accepted invitations to participate. A simultaneous meeting will be held at Chicago the same evening as usual.

Civil Engineers' Society of St. Paul.

A regular meeting of the Civil Engineers' Society of St. Paul was held Oct. 5, at 8:30 p. m., with 11 members and one visitor present, President Stevens in the chair. A discussion of continuous rails on concrete foundation in connection with asphalt pavements was opened by Mr. Wilson and continued by Mr. Curtin, both well prepared to present results of practice and observation.

Brotherhood of Railway Trackmen.

The biennial convention of this association was held in St. Louis last week. The chief of the organization is John T. Wilson, of St. Louis. The next meeting is appointed to be held at Macon, Ga. This association is a consolidation of the International Brotherhood of Railway Track Foremen of America and the Independent Brotherhood of Trackmen. The insurance features of the brotherhood include two policies, one for $1 000, the other for $500. Applicants may take either policy, but not both. The insurance feature is obligatory upon all members between the ages of 20 and 50 whose condition of health does not disqualify them.

Chicago Electical Association.

The Chicago Electrical Association has announced the following papers to be presented at the meetings to be held during the fall and winter:

Nov. 6, "The Metric System in Electrical Industries," F. S. Hickok; Nov. 20, "Daily Problems in Long-Distance Telephony," E. L. Andrews: Dec. 4, "Notes on the Modern Ground Return System," G. W. Knox; Dec. 18, "Decorative Lighting," E. J. Jenness; Jan. 15, "Conventional Diagrams of Electrical Apparatus," D. W. C. Tanner; Jan. 29, "New Uses for Electricity in Architecture," C. G. Armstrong.

W. Clyde Jones, 100 Washington street, is President, and J. R. Cravath, 890 Old Colony Building, is Secretary of the association.

Western Society of Engineers.

The Western Society of Engineers met Wednesday evening, Oct. 7, in Scientific Hall, Armour Institute Chicago, with Mr. J. J. Reynolds in the chair, and 103 members and guests present, including several ladies.

Mr. T. L. Condron read a paper on "Steel for Boilers and Fireboxes," with stereopticon views illustrating and explaining variations in the specifications of the Master Mechanics' Association, the various steel manufactures, locomotive builders and important railroads, as to tensile strength, elastic limit, etc., and with reference to the chemical requirements in steel.

Mr. H. F. J. Porter spoke on "Steel Forgings," from the practice of the Bethlehem Iron Company. Views with the stereopticon of the extensive plant of that company, of the cranes used in handling large ingots of steel while they are being forged by hydraulic machinery into armor plates, shafts and large ordnance. The steel was pictured in its various stages of reduction. Mr. Porter spoke without notes and presented much valuable information, and had the close attention of his hearers. These papers, with discussions, will appear in the Society *Journal*.

The next meeting will be held Wednesday evening, Oct. 21, when discussions of these papers will be had, followed by a paper on "Railroad Yards and Terminals," by Mr. H G. Hetzler of the C., B. & Q.

The society will visit the Bedford stone quarries of Bedford, Ind., and the works of the Western Cement Co., of Louisville, Ky., on Oct. 16 and 17. The L., N. A. & C. R. R. (Monon route) has offered free transportation to the society for this trip. The train will leave Chicago Thursday evening, October 15, returning so as to reach Chicago the following Sunday morning. The party will enjoy the hospitality of the owners of the quarries at Bedford on Friday, and that of the Cement Company at Louisville on Saturday.

PERSONAL.

—Mr. Thomas P. Fowler, President of the New York, Ontario & Western road, has sailed for Europe for a short trip.

—Mr. F. G. Patterson, President and Superintendent of the Altoona, Clearfield & Northern, was last week appointed as Receiver of the line.

—Commissioner George R. Blanchard, of the Joint Traffic Association, will sail from Southampton for New York on the steamship St. Paul this Saturday.

—Mr. H. Walter Webb, Vice-President of the New York Central & Hudson River road, was last week appointed temporary Receiver of the Ogdensburg & Lake Champlain, operated by the Central Vermont.

—Mr. C. Kadono is now Engineer of Construction of the Sanyo Railroad, Japan, with headquarters at Hiroshima. Mr. Kadono was formerly in this country, being employed in the Engineering Department of the Pennsylvania road.

—Mr. Horace Tucker, Traffic Manager of the Chicago, Hammond & Western the last few years, has retired from that position, and has been succeeded by Mr. S. S. Whitehead, recently General Freight and Passenger Agent of the Indiana, Illinois & Iowa.

—Mr. E. W. Mills, formerly Auditor of the Port Royal & Augusta road, which is now operated as the Charleston & Western Carolina, having been sold at foreclosure in September, has been elected Assistant Treasurer of the new company, his headquarters being changed from Port Royal, S. C., to Augusta, Ga.

—Mr. J. S. Bartle, now Assistant General Freight Agent of the Chicago, Burlington & Quincy lines at St. Joseph, Mo., has been appointed General Freight and Passenger Agent of the Indiana, Illinois & Iowa road, with headquarters at Chicago, succeeding Mr. S. S. Whitehead, who has resigned to accept a position with another company.

—Major William H. McClintock, Manager of the Alabama Car Service Association, at Birmingham, Ala., died at his home in that city on Oct. 2 at the age of 50. Major McClintock was for several years Superintendent of the Columbus & Western Division of the Central of Georgia. He had been at the head of the demurrage bureau in Birmingham five years.

—Mr. W A. Moody has been elected manager of the Alabama Car Service Association, to take the place of Maj. W. H. McClintock, who died last week. Mr. Moody is Purchasing Agent for the Howard-Harrison Iron Co. at Bessemer, but formerly was soliciting freight agent for the Richmond & Danville. He will also be Commissioner of the Southern Iron Committee.

—Mr. J. S. Leahy has been appointed General Southern Agent of the Cincinnati, Hamilton & Dayton, with headquarters at Cincinnati, in charge of business originating in Cincinnati, south of the Ohio River and east of the Mississippi River. Mr. J. R. McGregor has been appointed Traveling Passenger Agent, and Mr. Perry Griffin Northwestern Passenger Agent, with headquarters in Chicago.

—Mr. Lewis Kingman, Chief Engineer of the Atchison, Topeka & Santa Fe, in those years when it was expanding at such an unprecedented rate, and now Chief Engineer of the Mexican Central road, has been requested by the Atchison Company and the Atlantic & Pacific bondholders' committee to inspect the Atlantic & Pacific road, for the purpose of making an estimate of what would be the cost of reproducing it at the present time.

—Mr. Robert Neilson, General Superintendent of the Philadelphia & Erie road, died at his home in Williamsport, Pa., last Monday night, aged 59 years. He had been connected with the Pennsylvania and its branches for more than 30 years. Mr. Neilson was born in Canada, Aug. 19, 1837. After being graduated from the Rensselaer Polytechnic Institute in Troy, he entered the service of the Philadelphia & Erie as a rodman. After serving as Resident Engineer and Division Superintendent, in January, 1883, he was appointed General Superintendent of all lines of the Northern Central and the Philadelphia & Erie divisions of the Pennsylvania.

—Mr. Albert F. Noyes died suddenly in Boston on the morning of Oct. 12. Mr. Noyes was 45 years old and was a prominent citizen of Newton, Mass., where he had been a member of the Board of Aldermen, and, for many years, City Engineer. In 1893 he accepted an appointment on the Massachusetts State Board of Health, and in 1895 was made a member of the Metropolitan Sewer Commission. Mr. Noyes had been for 10 years a member of the American Society of Civil Engineers, and had also been President of the Boston Society of Civil Engineers and of the New England Water-Works Association, and he was a man much respected, personally and professionally.

—Mr. William Harrison Grant died at his home at Sing Sing last Saturday. He was born in 1815 and his first active work as an engineer was in surveys on the New York & Erie Railroad. He was Assistant Engineer on the Erie Canal for eight years; was later engaged on surveys for the Hudson River Railroad and on the construction of the Cleveland, Zanesville and Cincinnati Railroad. Later he became Superintending Engineer of Central Park, New York. In 1876 he set up in practice as a landscape architect, and afterward he was in the Government service on harbor work and various construction work. He became a member of the American Society of Civil Engineers in 1873.

—Col. J. H. Averill, Receiver of the Port Royal & Augusta, has transferred the property of that company to the new corporation, the Charleston & Western Carolina, which has been organized to operate it and has severed his connection with the property. Col. Averill has been connected for a number of years with this line and others of South Carolina. He became Receiver when the line, previously operated as a branch of the Central of Georgia, was separated from that system. In 1891 he had been Superintendent of the road, but left it to go to the South Carolina road, of which he became General Superintendent. He has also held a similar office with the Charleston, Sumter & Northern, previous to his appointment as Receiver.

—Mr. Henry Collbran, President of the Midland Terminal Railway of Colorado, has gone to Corea to investigate prospects for gold mining in that country. It is stated in Denver papers that Mr. W. K. Gillett, Vice-President and Treasurer, will become President of the Midland Terminal, though the report that Mr. Collbran has resigned is not confirmed. He goes to Corea in the interest of the firm that has a concession to build a railroad from Chemulpo to Seoul. He will also visit China. Mr. Collbran, who was born in England in 1852, began his railroad service in this country in 1882 and was in the traffic department of the Cincinnati, New Orleans & Texas Pacific and associated roads until 1888, when he went to Colorado, beginning there as Traffic Manager.

ELECTIONS AND APPOINTMENTS.

Carolina Central.—At the annual meeting of stockholders, in Wilmington, N. C., on Oct. 8, the old officers were re-elected. George N. Moale, of Baltimore, was elected a member of the Board of Directors, in place of John Gill, resigned.

Centralia & Chester.—J. E. Dean has been appointed Car Accountant, with office at Sparta, Ill.

Central of Georgia.—T. M. Cunningham has been elected Treasurer and Edward Workman Assistant Secretary. The office of Assistant Treasurer has been abolished. The nomenclature of the various divisions of this road has been changed as follows: The Main Stem Division will be called the First Division, S. C. Hoge, Superintendent; the Southwestern Division will be called the Second Division, B C. Epperson, Superintendent; the Savannah & Western Division will be called the Third Division, T. S. Moise, Superintendent.

Charleston & Western Carolina.—This company is the successor of the Port Royal & Western Carolina

and Port Royal & Augusta, recently sold at foreclosure. The new company has been organized with the following officers: J. B. Cleveland, President; Henry Crawford, Vice-President and General Counsel; W. A. C. Ewen, Vice-President and Treasurer; Alfred C. Jopling, Secretary; E. W. Mills, formerly Auditor, Assistant Treasurer. The following appointments took effect on Oct. 1: A. W. Anderson, Superintendent; W. J. Craig, General Freight and Passenger Agent; Wm. McLeod, Auditor. Their offices will be in Augusta, Ga.

Chicago, St. Paul, Minneapolis & Omaha.—A. G. Wright has been appointed Division Master Mechanic at Altoona, Wis.

Cincinnati, Hamilton & Dayton.—At the annual meeting of the stockholders Oct. 13, four Directors were re-elected: M. L. Martin, George W. Davis, Lawrence Maxwell, Jr., and George R. Balch.

Cincinnati, Lebanon & Northern.—At the annual meeting of stockholders at Cincinnati, Oct. 13, seven directors were elected, as follows: Joseph Wood, J. T. Brooks, J. C. Davidson, James M. McCrea, all of the Pennsylvania, and F. G. Wier, S. M. Felton, and George Haefer, of Cincinnati. The directors elected Joseph Wood President; S. B. Liggitt, Secretary; T. H. B. McKnight, Treasurer; Ralph Peters, Superintendent, and G. A. Rockwell, General Passenger and Ticket Agent.

Concord & Montreal.—At the annual meeting at Concord, N. H., Oct. 13, these Directors were chosen: Frederick Smyth, Benjamin A. Kimball, John H. Peterson, Walter M. Parker, John A. White, Alpha J. Pillsbury, Charles E. Tilton, Samuel S. Kimball, Charles E. Morrison, Lewis C. Pattee, Frank Jones, Noah S. Clark, Hiram M. Turner. Hon. Frank Jones succeeds Gov. C. A. Busiel, who was not proposed for re-election.

Duluth, Mississippi River & Northern.—D. R. Murphy has been appointed Superintendent to succeed H. O. Halsted, who has resigned to accept service with another company. His office is at Hibbing, Minn.

Erie.—C. L. Thomas has been appointed General Freight Agent and G. P. Whittlesey Assistant General Freight Agent of the Ohio Division, with offices at Cleveland, O.

Erie Dispatch.—The office of this line has been moved from Cleveland to New York City, and Mr J. T. Wann, Auditor of the Erie Railroad, has been appointed Auditor of the Dispatch Line.

Gulf, Beaumont & Kansas City.—John H. Phillips has been appointed Traffic Manager, with office at Beaumont, Tex.

Illinois Central.—H. U. Wallace has been appointed Roadmaster of the First Division, with headquarters at Chicago, in place of A. Philbrick, appointed Roadmaster of the Thirteenth Division, with headquarters at Memphis, Tenn. A. T. Sabin has been appointed Roadmaster of the Tenth Division, with headquarters at Louisville, Ky. F. W. Brazier has been appointed Assistant Superintendent of Machinery, with headquarters at Chicago. Mr. Brazier will also have jurisdiction over the Yazoo & Mississippi Valley.

Lake Erie & Western.—At the annual meeting of the stockholders in Peoria, Ill., on Oct. 7, the following directors were elected: Samuel Thomas, John G. Moore, and L. M. Schwan, of New York City, and Erskine M. Phelps, of Chicago.

Louisville & Nashville.—At the annual meeting of the stockholders, held in Louisville, Ky., Oct. 7, all the members of the old Board of Directors were re-elected.

Manitoulin & North Shore.—Officers of this road have been elected as follows: President, Peter Ryan; Vice-President, David Isaacs; Secretary, R. H. Bowes; Treasurer, David Phillips.

Mexican National.—E. D. Stegall has been appointed Master Mechanic, with office at Acanbaro, Mexico.

Minneapolis & St. Louis.—At the annual meeting of the stockholders, held in Minneapolis, on Oct. 6, the following directors were elected for a three-years term: C. S. Mellen, New Haven, Conn.; Edwin Langdon, New York City, and George Crocker, San Francisco. F. H. Peavey, Minneapolis, was elected to fill the unexpired term of W. L. Bull, resigned. At the meeting of directors held subsequent to the stockholders' meeting, the following officers were elected: Edwin Hawley, President; J. E. Searles, Vice-President; F. H. Davis, Treasurer: Jos. Gaskell, Secretary and Assistant Treasurer, and A. L. Mohler, General Manager. The Executive Committee elected were Messrs. Hawley, Davis, Mellen, Searles and Palmer.

Missouri, Kansas & Texas.—John L. Wigton has been appointed Master Car Builder of the lines north of Denison, Tex., with headquarters at Sedalia, Mo. W. M. Brehm has been appointed Master Mechanic of the lines north of Denison, with headquarters at Parsons, Kan.

Norfolk & Western.—The new Board of Directors is as follows: F. J. Kimball, Chairman; H. Fink, George Coppell, J. Kennedy Todd, Victor Morawetz, W. E. Glyn and W. B. Boulton, of New York; Joseph I. Doran, H. Whelen, Jr, and W. B. Campbell, of Philadelphia, and Col. Walter H. Taylor, of Norfolk, Va.

Northampton & Hertford.—G. H. Clark has been elected Vice-President, with office at Newark, N. J., to succeed A. L. Shepherd, deceased. The road is located in North Carolina.

Northern Pacific.—Announcement was made this week that the following gentlemen have been elected permanent directors of the new company, as reorganized: Edward D. Adams, representative in this country of the Deutsche Bank of Berlin, who will probably be Chairman, Charles H. Coster, of J. P. Morgan & Co.; Charlemagne Tower, Jr., of Philadelphia; Robert M. Gallaway, President of the Merchants' National Bank, New York; E. B. Thomas, President of the Erie road; Robert Bacon, of J. P. Morgan & Co.; D. Willis James; Francis Lynde Stetson; E. W. Winter, President of the Company; Samuel Spencer, President of the Southern Railway; Dumont Clarke, President of the American Exchange National Bank, New York; Brayton Ives; John D. Rockefeller; James Stillman, President of the National City Bank, New York, and Walter G. Oakman, President of the Guaranty Trust Company, New York City.

Ogdensburg & Lake Champlain.—H. Walter Webb, Third Vice-President of the New York Central, New York City, has been appointed temporary receiver of this road.

Pittsburgh & Lake Erie.—J. A. Atwood, heretofore Principal Assistant Engineer, has been appointed Chief Engineer in place of Mr. F. E. House.

Quincy Quarry.—At the annual meeting in Boston on Oct. 7 the following officers were elected: President, T. H. McDonnell; Vice-President, Wm. A. Hodge; Treasurer, Barnabas Clark; Directors, the above, with Edwin Hawkridge, John Swithen, James Lyons, Clarence Burgiss, James Thompson; Executive Committee, T. H. McDonnell, Andrew Milne, John Swithen, W. A. Hodge, Clarence Burgiss.; Superintendent, L. S Anderson.

St. Paul & Duluth.—At the annual meeting of the stockholders on Oct. 8 at St. Paul, Minn., the following directors were elected for three years: R. B. Dobson and John L. Riker, New York; A. B. Plough, St. Paul. The election of officers by the directors was postponed.

Sheboygan, St. Paul & Western.—The following officers of this road have recently been elected: President, Arthur Winter; Vice-President, Frank Geele; Treasurer, Frank Roenitz; Secretary, James Mallman; Attorney, Paul T. Krez.

RAILROAD CONSTRUCTION.

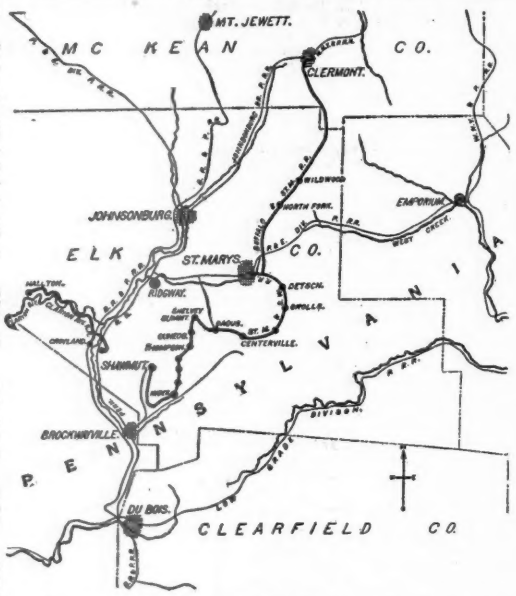
Incorporations, Surveys, Etc.

Aberdeen & Tennessee.—The stockholders elected officers as follows at a meeting at Aberdeen, Miss., last week: W. C. Fitzgerald, President; R. E Houston, Vice-President; John C. Wicks, Secretary; J. M. Walker, Treasurer, and H. J. Blann and David Johnson, Directors and Incorporators. The route of the proposed road is from the Tennessee River in Tishomingo County down the Tombigbee River Valley to Aberdeen to an intersection with the Mobile & Ohio, the Illinois Central and the Kansas City, Memphis & Birmingham roads. No active work has been done recently, but the officers expect to shortly complete plans for starting active operations.

Asheboro & Montgomery.—This road, which is practically an extension of the Aberdeen & West End, from Starr to Asheboro, N. C., has been completed and trains are now running between Aberdeen and Asheboro.

Buffalo & St. Marys.—This road, completed this year, is 25 miles long, extending through Elk County, one of the northern tier counties of Pennsylvania. It is longer than most of the lines which have been built in Pennsylvania in recent years, when railroad construction in the state has been very active, but its purpose is the same, to develop and give new outlets to the mineral resources of a section of the state. The new road extends the St. Marys & Southwestern, built in 1892, between Shawmut and St. Marys, 26 miles, by the same interests, across the New York State line to a connection with the Western New York & Pennsylvania at Clermont. The two roads thus practically form a route of 50 miles and give the coal mines in the southern and central part of Elk County an outlet to Lake Erie and the markets of the north and northeast. The coal underlies the Toby Valley and is a high-grade bituminous, known in the market as the Shawmut mines coal. It has been produced for 33 years and the yearly output has been large. In addition to this revenue the company's earnings from hauling lumber will be important. It is estimated that there is nearly 900,000,000 ft. of lumber along the line of the road. There are also thousands of tons of hemlock bark, now held in reserve by the principal stockholders of the railroad, which will be sent over the road. It is all located within easy access to the railroad. At St. Mary's a new saw mill, with a daily capacity of 150,000 ft. B. M., is being built. In connection with the mill an extensive kindling wood factory is to be put up and a company is now being organized to build a furniture factory. These new industries are all expected to be in operation within a short time and will give employment to several thousand additional men.

The road after leaving Shawmut runs southward down Meades Run and northeasterly along Toby Creek for five miles, the grades on this section being light, with a maximum of one per cent. For the rest of the distance

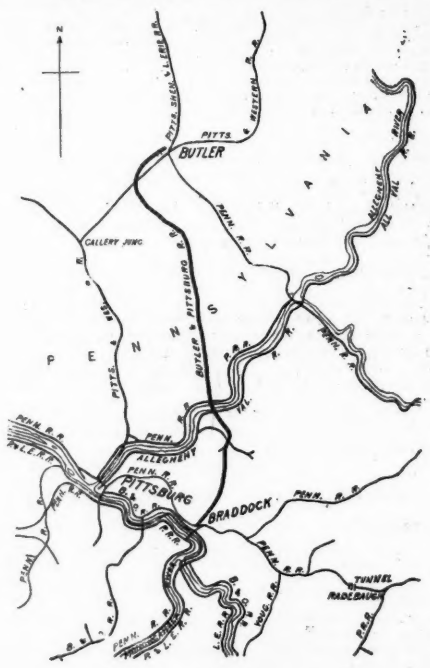


Buffalo & St. Mary's and St. Mary's & Southwestern Railroads.

to St. Mary's, the northern terminus of the St. Mary's & Southwestern, the grades are undulating, the maximum against traffic going north being 85 ft. to the mile and in its favor 100 ft. to the mile. The route of the Buffalo & St. Mary's, the newer portion of the line, which begins at St. Mary's, is along the summit of the Divide separating the eastern from the western waters in this portion of Pennsylvania, the entire line, with the exception of the first three miles out of St. Mary's, being through a hemlock and hardwood forest. On this division the maximum grades are substantially the same as those mentioned. Twelve-degree curves have been used at a few points to avoid unnecessarily heavy work in the mountains, but otherwise the average curves are five and six degrees. In the newer road, north of St. Mary's, there was some heavy grading, which included earth, loose and solid rock, but of the latter only a small proportion. One cut involved 50,000 cu. ft. of excavation. About 1¼ miles out of St. Mary's the new road crosses the Philadelphia and Erie division of the Pennsylvania by an overhead bridge. It is a steel girder, crossing the Pennsylvania track with an oblique clear span of 68 ft. 8 in., clearing the top of the Pennsylvania rail vertically 22 ft. It rests on two stone abutments, each 30 ft., at right angles from the center, between the Pennsylvania track. The Buffalo & St. Mary's is laid with 75-lb. rails, and metal tieplates are used. The St. Mary's & Southwestern has 70-lb. rails. The company's equipment includes two engines now used in improvements on the road and three engines used in passenger and freight traffic which were built at the Brooks Locomotive Works and weigh 72 tons on the drivers.

The Clarion River road, which is also shown on the map, is an older line, built chiefly to reach timber. It is controlled by the interests which have built the St. Mary's & Southwestern and Buffalo & St. Mary's roads, and own large holdings in the Shawmut coal mines. It will probably be connected at some time with the St. Mary's & Southwestern.

Butler & Pittsburgh.—This road, projected to give the Carnegie Works a new and direct outlet to Lake Erie, will have so considerable an effect on the routes now carrying the important ore and steel freights be-



Butler & Pittsburgh Railroad.

tween the mills in the Pittsburgh district and Lake Erie that as complete a description of the road as can be obtained at present will be interesting to many of our readers. The charter of the company was granted at Harrisburg, Pa., on April 8, 1896, and authorized the building of a line connecting the Pittsburgh, Shenango and Lake Erie road at Butler, Pa., with the Union Railroad at Bessemer, a distance of 42½ miles. This new road is closely identified with the Pittsburgh, Shenango & Lake Erie and will give that line an entrance into Pittsburgh. The Union Railroad is a short line connecting the various mills of the Carnegie Steel Co. with each other and with the railroads entering Pittsburgh.

The new road has a capital of $5,000,000, of which it is said $2,000,000 has been subscribed by Mr. Andrew Carnegie. The officers are Mr. John T. Odell, President; R. A. Franks, Secretary; F. E. House, Chief Engineer, with general offices in the Carnegie Building, Pittsburgh. The entire line has been located, and the portion between the Allegheny River and Butler, 31½ miles long, is now more than half finished. The contract is let to C. I. McDonald, Penn Building, Pittsburgh, who has sub-contracted the grading to Ferguson Contracting Co., Corning, N. Y.; T. A. Maselli, Columbus, O.; C. B. Donaghy, Portsmouth, O., and Breen & Butler, Chicago. Grady, Coda & Co., Beaver Falls, Pa., will build the masonry; C. I. McDonald is building the only tunnel, 350 ft. long, and has placed Samuel Harrold, of Beaver Falls, in charge. About 1,000,000 brick will be used for lining. He is also excavating the Summit cut, one of the most important contracts on the entire line; over 162,000 cu. yds. of earth must be taken out. This cut, with a few breaks, is 3¼ miles long, 55 ft. deep and has fills 85 ft. high.

As shown by the map, the line is almost an air line, except the entrance into Butler, and the maximum grade, southbound, is 32 ft. to the mile; northbound, 39 ft., except out of Bessemer, where a 71 ft. grade is necessary. The country traversed is a rich farming district, though very rough, large cuts and fills are required to obtain the above gradients. The country abounds in minerals, and a large area of coal lands will be developed.

The line between the two rivers—the Allegheny and Monongahela—will be put under contract in a few weeks. It is 12 miles long, and includes a tunnel 2,700 ft. long, at the mouth of which, in Thompson's Run, will be located shops of a capacity sufficient to serve the entire line—from the Monongahela River to Lake Erie.

The principal business of the road will be in handling iron ore and lumber southbound, and coal, coke and steel northbound. The Carnegie Steel Co., with an annual production of about three million tons, will, by this new line, receive its lake ores direct from Conneaut docks, on Lake Erie, and ship its finished products back by the same route, avoiding the expense and delay of transfer through Pittsburgh.

The Allegheny River will be crossed at a height of 130 ft. above low water by a steel bridge 3,000 ft. long. The bridge over the Monongahela River, between Bessemer and Homestead, will be built by the Union Railroad. It is expected to have plans for both of these bridges ready for contractors in a few weeks.

The Pittsburg, Shenango & Lake Erie is making surveys with a view of changing alignment and reducing grades to the maximum adopted by the Butler & Pittsburgh. The cost of these improvements is estimated at $300,000.

Cincinnati, Jackson & Mackinaw.—The Jackson extension of this company, completed during the year, was built under the name of the Jackson & Cincinnati. It is 17.8 miles long and extends from Addison north to Jackson, and gives the company connections with six roads, with which it formerly had no connection. The

grading was begun in October, 1895, and completed in March, 1896. The tracklaying started Jan. 15 and was finished April 15, at which time the road was opened for traffic. No difficulty was experienced in the construction of the road, as the work was comparatively light, requiring about 350,000 yds of excavation, of which a very small per cent. was loose and solid rock. There is only one trestle of importance, that 1,000 ft. long, with an average height of 21 ft., over Goose Creek Valley at Woodstock. There are only three trestles on the entire line, aggregating 1,100 ft. One 62-ft. girder carries the line over the Ypsilanti branch of the Lake Shore & Michigan Southern at Woodstock. The maximum grade is 42 ft. to the mile (5,000 ft.), and the maximum curvature is 3 deg. The total curvature is 11,900 ft.

Cincinnati, Portsmouth & Virginia.—The roadbed is to be changed on this road between Winchester and Newport, O., and the distance between the two places will be shortened about three miles. The present distance is 10.5 miles. The trestle over Elk Run, one mile east of Winchester, will be replaced by an iron bridge, which will be built one-half mile further up the creek, to avoid the present curve.

Erie.—Work was begun last week on double-tracking the line between River Edge and Oradell, on the New Jersey and New York Division, one of the important suburban lines out of New York. Some trouble has been met with in regard to the right of way for the second track at a point in River Edge, and it may be found necessary to make a slight curve at that place.

Erie & Eastern.—The route of this proposed new road, south from Erie, Pa., has been finally decided upon. The road will extend from Erie, south, 20 miles, to Millvillage, from which point trains will be run over the tracks of the Meadville Division of the Erie, through Meadville and Franklin, to Oil City, a total of 79¼ miles. This route to Oil City will be 3¼ miles shorter than the existing route, via Corry. Connection will be had with Titusville, via the Titusville, Cambridge & Lake Erie, from Cambridge.

Greenwood, Anderson & Western.—This company, which leases and operates the Carolina Midland, is extending that road north from Seivern to Batesburg, S. C. The road now extends from Allendale north to Seivern, 55 miles. The extension to Batesburg will be 15 miles long, and will give the road connection at Batesburg with the southern system. Twelve miles have been graded and six miles of rails have been laid. It is expected that the line will be completed by Nov. 15. It is the intention to build a further extension of the road, from Batesburg to Greenwood, 40 miles. Major Thomas B. Lee is Chief Engineer of the work.

Hendersonville & Brevard.—This road, completed less than one year ago, and operating between the towns of Brevard and Hendersonville, N. C., at which latter place connection is made with the Southern road through the Western North Carolina road, will build an extension from Brevard to Mills River.

Indiana Mineral.—A company just incorporated, under this name, in Indiana, announces its purpose to build a road from St. Louis to Cincinnati and Dayton, O. Surveys were begun 18 months ago, under E. C. Rice, and a line has been located, passing through Terre Haute, Ind. The proposed line from St. Louis to Terre Haute is very direct. From Terre Haute it runs east to Shelbyville, and then northeast, and divides at Cynthiana, the south branch going to Cincinnati and the north branch to Dayton. The Dayton survey passes through Rushville, Richmond, Eaton and West Alexandria to Dayton. The Cincinnati line runs due east through Milroy, Metmora and Harrison.

Louisville & Nashville.—A further extension of the Pineapple division of this road, now operated from Selma, south 40 miles to Pineapple, Ala., is proposed, to reach the Florida state line. The extension is to be about 15 miles long, running in a general southwesterly direction from Pineapple, passing through Pineville, Monroeville, Jonesboro and Bear Creek Mill to Hollinger's landing, on the Escambia River, near the Florida line. A logging road of standard gage will be utilized.

Manitoba & Lake Dauphin.—Chief Engineer, T. H. White states that the line will be surveyed and graded a considerable distance past the town of Dauphin, Man., this fall. Track has been laid on 45 miles, and the line has been graded to a point 90 miles from Gladstone. The road will be 120 miles long, running from Gladstone, on the Manitoba & North Western road, in a general northwesterly direction through Dauphin.

New Roads.—A charter has been applied for by a company formed to build a road, 12 miles long, to connect the Delaware, Lackawanna & Western, at Gregsville, Livingston County, N. Y., with the Silver Lake Railroad, at Perry, Wyoming County. Preliminary surveys of the proposed line have been made. The road will be built principally to accommodate salt shipments, and will be used largely for freight. A. G. Yates, Harry Yates, Cyrus F. Polley and others, of Rochester, N. Y., are interested.

New York & Pennsylvania.—This road is now nearly completed to Canisteo, N. Y., and it is expected that regular train service will begin before Nov. 1. The road is 42 miles long, from Oswayo, Pa., to Canisteo, N. Y. Grading has been completed, and rails have been laid from Oswayo to the long bridge near Canisteo. An agreement has been made with the Erie road, whereby trains will be run from Canisteo into Hornellsville over its tracks. Yard and round-house facilities have been provided in Hornellsville. Two regular passenger trains will be run between Hornellsville and Oswayo, in each direction, daily.

Northern New York.—It is proposed to extend this road, from its southern terminus, at Tupper Lake, 20 miles further south, to Long Lake, and it is hoped that work will begin before January. An ultimate extension from Long Lake to a connection with the Delaware & Hudson, at North Creek, Saratoga County, is also proposed. This will open up all the lower part of the Adirondack Mountains.

Rio Grande, Sierra Madre & Pacific.—Tracklaying on this road was begun at Ciudad Juarez last week. The road will extend from Ciudad Juarez, directly across the Rio Grande from El Paso, Tex., in a general southeasterly direction, through Corralitos, to a point near Casas Grandes, a total distance of 156 miles. J. Fewson Smith, of Ciudad Jaurez, is Chief Engineer of the road.

St. Louis & Oklahoma City.—M. L Lynch, Chief Engineer, has made his report to the directors, giving an account of the locating survey of the line of this proposed road, which he has just completed. The line, starting at Sapulpa, I. T., at the terminus of the St. Louis & San Francisco, extends in a generally southwesterly direction 169.4 miles to Oklahoma City, Oklahoma Territory, the terminus at the last-named town being beyond the tracks of the Choctaw, Oklahoma & Gulf, and of the Atchison, Topeka & Santa Fe. The line as laid out will require no grade greater than one per cent., although at three or four places it will be necessary to do some heavy work in order to keep within this limit. The maximum curvature will be 4 deg. The first 41 miles from Sapulpa lies in the Creek nation. Several tributaries of the Canadian River are here crossed, but the bridging is light, the longest span being 125 ft. There will be needed five plate-girder bridges 40 ft. long and two 50 ft. long, with short trestle approaches. The land in this region is arable, of a good quality. Corn will yield 50 to 60 bushels to the acre and cotton three-fourths of a bale to the acre. The country here is well timbered and will furnish a sufficient supply of oak ties and other timber for the construction of the whole road. Building stone is also accessible. Coal of good quality is already being taken out of the mine near Sapulpa and surface indications promise coal in several other places. Natural gas in small quantities rises through the water to the surface of a creek near Kellyville In Oklahoma the line follows the slope of the Deep Fork and North Fork of the Canadian River and runs through the town of Chandler. The land here is well suited to the cultivation of cotton. The strength of the soil is indicated by the fact that the engineers, in running their line, had to chop down sun flowers 25 ft. high and 3 in. in diameter. The country traversed in Oklahoma is occupied by actual settlers on nearly every quarter section, and a large proportion of the land has been brought under cultivation.

San Francisco & San Joaquin Valley.—Tracklaying has been completed into Fresno, Cal., and on Oct. 6 the road was formally opened for passenger traffic between Stockton and Fresno. Governor Budd, of California, officiating at the ceremonies.

Southern.—Work has been begun at Rockmart, Ga., on a short branch, to connect this road with the East & West Railroad. The branch will run from a point on the Southern's trestle, north of the town, to a point on the East & West, just east of the Euharlee Hotel. This connection will enable the iron ore companies, at Cedartown, Ga., to ship their product to Chattanooga, via the Southern.

South Georgia.—A first mortgage for $30,000 is to be issued to complete and extend this road, building in South Georgia, primarily for lumber purposes. The road is already graded from Quitman, Ga., to Heartpine. The piles of all the bridges have been driven and capped ready for the rails, and rails have been laid from Heartpine to Morven, a point 12 miles from Quitman. The bonds when issued will be readily taken by the stockholders of the company.

Tennessee, Georgia & Atlantic.—The charter for this road, which authorizes a line to connect the cities of Chattanooga, Tenn., and Augusta, Ga., has just been granted. The incorporators named in the charter are: Henry E. King, A. B. Cornell, Francis M. Ferguson and Joseph Gilfillan, of New York; Hon. Hoke Smith, G. V. Gress, E. A. Richards and J. W. English, of Atlanta. The company was formally organized at Athens, Ga., Oct. 10, by the election of the following officers: President, Hon. A. B. Cornell, of New York; Vice-President and General Manager, E. A. Richards, of Atlanta; Second Vice-President, Jacob Haas, of Atlanta; Secretary, D. H. Livermore, of Atlanta; Treasurer, W. S. Witham, of Atlanta. Directors: A. B. Cornell, H. E. Knox, W. C. Hale, E. A. Richards, D. H. Livermore, H. A. Blake, G. V. Gress, E. C. Machen, W. S. Witham. The capital stock is $5,000,000 and the company will be operated in connection with a construction company organized at Atlanta last week under the name of the United States Construction Co., the capital stock of which is $250,000, of which ten per cent has been paid in. The road will be built to the town of Lula, from Chattanooga. At Lula connection will be made with the Northeastern road (now operated by E. A. Richards under a lease from the state) and thence entrance will be made into Augusta. The business men of Chattanooga and Augusta have long desired direct connection by rail between the two cities and this project finds a popular reception at both cities.

Texas Midland.—Tracklaying was completed into Paris, Lamar County, Texas, on Oct. 10, and connection will be made immediately with the tracks of the St. Louis & San Francisco. This completes the work of extending the line from Greenville, Tex., to Paris.

Western Maryland.—An extension of the road is proposed from York, Pa., 15 miles east, to connect with the Philadelphia & Reading, on the eastern side of the Susquehanna. A bridge over the river is proposed at a point one mile west of Columbia, called Furnace Hill. The route for the extension from York has already been surveyed and estimates made of the cost of the work.

Wilkes-Barre & Northern.—Track-laying on this new line between Luzerne Borough and Dallas will be completed this week, but considerable ballasting remains to be done. This will, however, be completed within a month. The road will probably be in operation by Dec. 1. As soon as the road to Dallas is completed, grading to Harvey's Lake, 15 miles north of Luzerne, will begin without delay. The road has an average grade of only 2 per cent. between Luzerne Borough and Dallas.

Electric Railroad Construction.

Annapolis, Md.—We have been informed that the survey of the proposed Washington, Annapolis & Chesapeake Railroad has been completed as far as the Patuxent River. Preliminary surveys have also been made on other sections of the proposed road.

Baltimore, Md.—Specifications are being prepared for the construction of a new electric line on Wolff and other streets in East Baltimore by the Central Railway Co. No contracts have as yet been let.

On Oct. 4 the motive power of the Druid Hill avenue line of the Baltimore Traction Co. was changed from cable to electricity. This is the last of the lines of the Traction Co. to use electricity. The company expects to place 30 new cars on the Druid Hill avenue branch.

Boston, Mass.—The City Council of Quincy has ordered a hearing on the petition of the Quincy & Boston Street Railway Co. for a location for double-tracking its lines from the junction of School and Franklin streets over School and Hancock streets to the boundary line of Boston at Neponset.

Buffalo, N. Y.—Consents of property owners were filed Oct. 2 representing all persons who were willing to permit the Buffalo Traction Co. to lay tracks in some of the principal streets in Buffalo.

Cambridge, Md.—An effort is being made in the southern portion of Dorchester County to revive interest in the Cambridge & Chesapeake Railroad in Dorchester County. The estimated cost of the road is $150,000. In 1893, the road was surveyed and grading begun and the work was pushed rapidly forward for a short time, but was then discontinued. Among the directors of the company are: Wm. F. Applegrath, of Golden Hill, and Victor C. Carroll, of Church Creek.

Carlisle, Pa.—The Borough Council has awarded the ordinance, granting the Cumberland Valley Traction Co. a franchise by allowing it to remove its tracks on York street and lay tracks on East Main street. The company has completed all arrangements for the right of way to finish the Boiling Springs route, as noted in our issue of Oct. 2. The line will run out East Main street and the Trindle Spring road in a southwesterly direction.

Chicago.—The Chicago City Railway Co. proposes to build an electric line in Woodlawn avenue, from Forty-seventh to Sixty-seventh streets, which will be a continuation of the Forty seventh street line.

Columbia, Pa.—The Town Council has agreed to extend the time for the completion of the Columbia, Mt. Joy & Ironville Electric Railroad to Oct. 1, 1897.

Derby, Conn.—John Fagan & Sons have been awarded the contract for the construction of the road in Derby, Conn., to be built under the direction of the Sheldon Street Railway Co.

Johnstown, Pa.—John R. Caldwell, of Indiana, is to make the surveys for the new electric road from Johnstown to Nineveh, a distance of about 12 miles. The road will parallel the Pennsylvania Railroad.

Harrisburg, Pa.—The Harrisburg Traction Co. has been granted an ordinance to extend its lines on a number of the principal streets in East Harrisburg.

Merchantville, Pa.—The ordinance for an electric road in Merchantville has passed its second and third reading, with but one amendment. The company will be required to place a substantial road from the outer rail to the curb, and keep the same in good condition. Wm. S. Scull is President of the newly formed company.

Milford, Mass.—The Medway Selectmen have voted to grant a franchise to the Milford, Holliston & Framingham Street Railway Co. to build an electric road from Milford to Medway, a distance of about six miles.

New Orleans.—A portion of the new electric road which is being built by the Canal & Claiborne Railroad Co. is completed. The power-house will be ready soon, but for the present power will be taken from the power-house of the St. Charles Street Railroad Co. About 22 cars will run at present. Seventy-pound T and girder rails have been used.

Pittsburgh, Pa.—A large force is at work grading for the new link which is to complete the loop of the West End Traction Co. from Sheridan to Elliott. The extension will cross the bridge at the Panhandle station at Sheridan and run over the ridge above the tunnel, connecting at Ingram with the Crafton and Ingram branch af the Carnegie line, now in operation, which intersects the main line at Oak Park. From Sheridan the route to the city is along the hillside and up through the valley to Elliott borough, where it will connect with the Elliott extension of the West End line, which reaches that place via Stuben street. This will form a loop from Temperanceville to Elliott, Sheridan, Ingram, Grafton and Idlewood.

The Second Avenue Traction Co. has started work on a permanent roadbed and track on its California avenue branch, from Woodland avenue to city line at High Bridge. This is the old Pleasant Valley line. T rails and new ties will be used, and granite block will be laid between the rails and for a distance of one foot on either side.

On Oct. 6, ordinances were introduced to the city council by the Inter-Urban Co. and the Manchester Traction Co. for a right of way in Avalon, one of the suburbs of Pittsburgh.

Rome, N. Y.—City Council has approved the measure compelling the Rome Traction Co. to entirely abolish the horse lines in the city and substitute electric roads in their places. The transformation is to be completed within four years.

Budapest, Hungary.—The Hungarian government has authorized the construction of an electric railroad between Budapest and Trieste by the way of Lake Balaton, Fured and Csakathurn. The construction work will be under the direction of the Societe de l'Industrie Electrique of Geneva.

Germany.—It has been decided to build an electric road between St. Johann, St. Ingbert and Neunkirchen.

The electric railroad between Haaren, Wurselen and Baidenberg, and also the road between Haaren, Weiden and Linden have been completed and are now in active operation.

Manchester, England.—*Industries and Iron* (London) informs us that it is proposed to build an electric road from Southport to Lytham across the Ribble, a distance of about 7 miles. A drawbridge will span the channel so as to not interfere with the navigation of the river.

Paris, France.—The capital stock of the Thompson-Houston Electric Co. of Paris has been increased from $1,000,000 to $2,000,000.

St. Petersburg, Russia.—It has been reported that the Russian Ministry of Way and Communications has resolved to carry out a series of experiments with electric locomotives on the St. Petersburg & Moscow and the St. Petersburgh and Warsaw linos.

GENERAL RAILROAD NEWS

Altoona, Clearfield & Northern.—A petition for the appointment of a receiver was filed in Blair County Court, in Pennsylvania, last week, and F. G. Patterson was appointed Receiver. The company, in its answer to the proceedings, admitted that the road was unable to pay interest on its bonds or to meet its actual operating expenses. The road is 15 miles long, extending north from Altoona through Blair and Cambria counties.

Baltimore & Ohio.—Messrs. John K. Cowen and Oscar G. Murray have filed in the United States Court their sixth report, showing receipts and disbursements in the operation of the railroad last August. The total receipts were $2,942,996, including $2,593,756 from traffic and $349,340 from miscellaneous sources, making a total of $3,362,701 with the balance of $419,704 from the previ-

ons month. The disbursements were $2,890,503, being $324,489 for traffic and $2,566.014 for miscellaneous purposes, leaving a balance of $472,198 on hand at the end of the month.

Columbus, Hocking Valley & Toledo.—The company has filed for record in Ohio a four per cent. general lien mortgage for $30,000,000 to the Guaranty Trust Co. of New York. Of this sum $22,000,000 is to retire outstanding bonds and the remainder is reserved for construction purposes and additions. The company reduces its interest rate from seven to four per cent.

Columbus, Sandusky & Hocking.—The officers state that traffic arrangements are in progress by which the company expects to run trains over the Wheeling & Lake Erie road from Bellevue to Toledo, and thus gain a connection with roads leading into Michigan. This would also give the Columbus, Sandusky & Hocking road another lake outlet.

Illinois Central.—The company reports its income from traffic for the two months ended Aug. 31, 1896 and 1895, as follows:

	1896.	1895.	Inc. or dec.	
Miles operated	2,127	2,888	I.	239
Gross earn	$3,305,455	$3,148,722	I.	$156 733
Oper. exp. and taxes	2,560,126	2,245,808	I.	314,318
Net earn	$745,329	$902,914	D.	$157,585

The gross receipts from traffic for September, 1896, are estimated at $1,917,364. The receipts for September, 1895, were $1,729,091, an estimated increase of $188,273.

International & Great Northern.—The company reports for the year ending June 30:

	1896.	1895.	Inc. or dec.	
Gross earn	$3,174,112	$3,491 653	D.	$317,541
Oper. exp.	2,382.490	2 366,389	I.	116,101
Net earn	$691,622	$1,125,264	D.	$433,642
Other income	34,771	14,260	I.	20,511
Total income	$726,393	$1.139,524	D.	$413,131
Fixed charges	889,802	858,969	I.	30,833
Deficit	$163,409(sur)	$280,555	I.	$443,964

Louisville, New Albany & Chicago.—The committee appointed by the bondholders soon after the receivership issued a plan of reorganization this week which provides for the formation of a new company to be called the Chicago, Indianapolis & Louisville Railway Co., which shall acquire the existing property assets and the Indianapolis terminals, Lafayette shops, Kentucky bridge bonds, equipment, etc. The company shall issue $15,000 000 in bonds, $5,300,000 to take up existing division issues, $6,100,000 to take up the consol 6s, general 5s, and equipment bonds, $1,500,000 to be sold for cash to a syndicate, and the balance, $2,091,000, to be deposited with a trustee to be used for betterments, etc., in amount not exceeding $400,000 a year. In addition $5,000,000 in four per cent. non-cumulative preferred and $10,500,000 in common stock will be issued. The existing preferred stock shall have the privilege of subscribing for an equal amount of common stock in the new company at $7 50 per share, receiving, in addition thereto, new prefered stock equal to the amount of cash paid. The existing common stock shall have the right to subscribe at $7.50 per share for an amount of common stock in the new company equal to one-third of the existing common stock, receiving with each subscription, in addition, new preferred stock equal to the amount of cash paid. The effect of these provisions will be as follows: Each $100 of existing preferred stock will receive $100 of new common stock and $7.50 of the new preferred, paying therefor $7.50 in cash. Each holder of $300 of existing common stock will receive $100 of the new common and $7.50 of the new preferred upon payment of $7.50 in cash. The plan contemplates a reduction of fixed charges to $698 450 for interest and $210,000 for rentals, against an average net earning capacity of $1,093,308 during the last five years.

Missouri, Kansas & Texas.—The report for the year to June 30 shows the following general results:

	1896.	1895.	Changes.	
Gross earn	$11,036 987	$11 544 363	D.	$507,376
Exp. and taxes	7,704,100	8,421,184	D.	717,084
P. c. exp	70	73		
Net earn	$3,332 887	$3,123,179	I.	$209,708
Int	3,316,494	2,898,440	I.	418,054
Surplus	$16,393	$224 739	D.	$208,346

Average mileage operated 2,117, against 2,028 the previous year. Gross earnings per mile, $5,140 against $5,692. Net earnings per mile, $1,552, against $1,540. The company is free from floating debt. The increase in the item of interest paid is owing to the fact that the payment of full interest on the second mortgage bonds became obligatory and was paid during the year. The gross earnings for the first three months of the current fiscal year as compared with the corresponding period of last year were as follows:

	1896.	1895	Inc.
July	$807,668	$750,270	$56 798
August	983,599	881,311	102,288
September	1,206,893	1,055 967	151,536
Three months	$2 997,400	$2,686,848	$310,552

New England.—The first annual report of the reorganized road has been issued in Boston and is for the ten months ending June 30, 1896. The earnings from passengers were $1,490 570; from freight $2,999 588, which shows some improvement over the earnings of 1895. The physical condition of the property has been improved; 3,200 tons of steel rails will have been put into the track when the season closes; 25 miles of road were ballasted with gravel, making a total of 135 miles in three years. About 300,000 ties were put in during the year.

For some time to come considerable expenditures on roadbed and equipment will be necessary. To provide brakes and couplers, according to United States law, company must expend before January, 1898, about $400,000. Large amounts will also be needed during the next few years for elimination of grade crossings.

President Clark adds: "The figures cannot be regarded as decisive of results which may be anticipated from the operation of the property in the future Sufficient time has not elapsed to allow the company to realize the full benefit of the changes which have been made, involving the adjustment of divisions and tariffs, the consolidation of freight and passenger facilities and the reduction of train mileage."

The report of the Reorganization Committee of the New York & New England is appended. It places the deposits of stock at 38,119 shares of preferred and 198,159 of common. The committee received in cash $9,997,085, of which $4,915,875 was from assessment on the stock and $4,812,500 from the sale of bonds. The committee expended in the purchase of various securities and obligations of the New York & New England Railroad Company $8,492,756. For guaranteeing and underwriting assessments $400,000 was paid: for counsel fees, $172,971; "committee's expenses, disbursements and fees," $193,018; for receipts, transfers and issue of certificates, $79,089. The committee reserved $100,000 to meet unadjusted claims. After all obligations were met there remained a balance of $500,288.

Northeastern of Georgia.—The road was taken out of the hands of the Receiver, Martin Dooly, Superintendent of the line, and returned to the charge of Ed. A. Richards & Co. by the order of the State Court, after the hearing of the application for a permanent receiver, made before Judge Hutchins at Lawrenceville. Richards & Co., the lessees, announce that they have completed arrangements with New York capitalists by which the road will be extended at both ends. The Northeastern is the property of the state and extends, at present, from Lulu to Athens. The road was leased some time ago to Ed. A. Richards & Co., for an annual rental of $18,000.

Quakertown & Easton.—Quo warranto proceedings have been begun against this road, before the Attorney-General, at Harrisburg, Pa., to annul the charter. Irregularities in the organization of the company are alleged.

Seaboard & Roanoke.—The daily papers announce that the sale of a controlling interest in this road to Thomas F. Ryan and Samuel Thomas has been confirmed, though nothing official has been given out. The same interest has also secured control of the Baltimore Steam Packet Company, known as the Bay Line, which is the Baltimore boat connection with the Seaboard Air Line. It is said that the new owners intend to consolidate the steamboat company with the railroad company. It seems to be understood that the rate-cutting policy of this road, which has made so much disturbance during the last two or three months, is to be abandoned.

Electric Railroad News.

Bridgeport, Conn.—A controlling interest in the Bridgeport Traction Co. has been purchased by the N. Y., N. H. & H. Railroad Co. About six weeks ago the Stamford and Norwalk lines were bought.

Brooklyn, N. Y.—Among our news notes of Aug. 21, we published the financial statements of the Brooklyn Heights Railroad Co. for the fiscal years ending June 30, 1896, and June 30, 1895. The following figures covering the same period will be of interest. The operating expenses are divided as follows:

	1896.	1895.	Inc.	Dec.
General exp	$286.447	$487,203	.....	$200,756
Transportation exp	1.719,298	1,673,655	$45,643	.....
Main. of way and buildings	153,310	267,149	.....	113,839
" " equipment	344,169	431,797	.....	87,628

The company reports the following additions and betterments on leased lines during the year (paid for by the lessor, the Brooklyn City road):

Track and roadway construction	$361,839
Overhead construction	84,939
Engineering	7,208
Buildings and fixtures	115,081
Miscellaneous equipment (motors, trucks, armatures, controllers, etc)	202,449
Car equipment	37,493
Power-station equipment	4,780
Miscellaneous	62,289
Total	$876,142

The total amount of money advanced by the Heights Co. for reconstruction and extensions of the Brooklyn City Railroad Co. to June 30, 1896, was $2,821,704. This amount, with additions hereafter made, is under the terms of the lease to be reimbursed to the Heights Co. at the termination of the lease. The number of passengers carried during the year was 106,686,306, as against 100,879,646 during the preceding year.

Chicago, Ill.—The North Chicago Street Railroad Co. has issued $1,427,000 new bonds. The security consists of $758,000 North Chicago Street Railroad five per cents issued under the mortgage dated July 1, 1896, and maturing Jan. 1, 1906.

Detroit, Mich.—The Detroit Citizens' Street Railway Co. has renewed its chattel mortgage of $3,000,000. The mortgage is in favor of the Washington Trust Co., of New York, and runs for one year.

Knoxville, Tenn.—J. Simpson Africa, President of the Union Trust Company, of Philadelphia, recently bought, as trustee, the lines of the Knoxville Street Railway Co. at foreclosure sole. He filed a bill against the city of Knoxville and the Citizens' Street Railway Co. alleging that he owned a franchise covering all the streets of Knoxville. The lower court sustained his contention, but the Circuit Court of Appeals has reversed the decision.

Middletown, O.—The Middletown & Madison Street Railroad was recently sold at auction to F. D. Douglas, of Monroe, O., for $9,072, which is two-thirds of its appraised value. This is the third time the road has been sold by the receiver, both former sales having been set aside.

Oswego, N. Y.—On Oct. 3, the Lake Ontario & Riverside Railroad Co., which controls the Oswego Street Railroad Co., went into the hands of F. H. Tidman, as Receiver. The road was chartered in May, 1885, with an authorized capital stock of $200,000; par value, $50 per share. The road has recently made extensive improvements; but were unable to meet its obligations caused by these betterments.

Spencer, Mass.—The receipts of the Warren, Brookfield & Spencer Electric Railroad Company, of Spencer, Mass., during the first 67 days of its operation were $11,616, which represents a collection of 235,337 five-cent fares. The road was granted a charter about March 1, and was built by the Worcester Construction Co.

Washington, D. C.—Mr. W. K. Schoepf, the receiver of the Maryland & Washington Railroad Co., the Columbia & Maryland project for a road between Baltimore and Washington, has filed a petition asking that he be allowed to issue $75,000 of receiver's certificates, constituting a first lien on the property of the company, in order to complete the road. He states that unless some measure of this kind is taken the amount already invested, $189,757, will be in danger of total loss.

TRAFFIC.

Traffic Notes.

The active grain movement in some parts of the West has begun to tax the railroads, and in Iowa the State Railroad Commissioners are receiving complaints of lack of cars.

The San Francisco & San Joaquin Valley has made reductions in the rates on lumber and flour in carloads, and from points where the competition affects the Southern Pacific the latter has followed with similar reductions.

The distribution of grain for export seems likely to be affected by changes in conditions of ocean traffic. In Philadelphia exporters state that ship masters will not take grain even at prices higher than anything ever before heard of, other kinds of freight being found more desirable. At Galveston the scarcity of vessels has caused much inconvenience to the railroads.

A press dispatch from Montgomery reports that the Southern Wholesale Grocers' Association has succeeded in getting the railroads to make carload rates from the West on flour, grain, provisions and some other commodities. It is stated that on these commodities the rates hitherto have been the same, regardless of quantity, and that the grocers' demand has been pending for four years. The report states that the question was referred to arbitrators. The difference between C. L. and L. C. L., which they have decided upon, is quite small. The precise percentage is not stated.

Chicago Traffic Matters.

CHICAGO, Oct. 14, 1896.

The Union Pacific is objecting to the actions of the lines running northwest from Galveston regarding the ticketing of European emigrants from that port. The U. P claims that its immigrant business is being hurt by the diversion of this traffic from New York and Chicago to the Gulf port; and that its proportion of the traffic under the Western Emigrant Agreement should be slightly increased or some action taken to get an agreement with the trans-Atlantic steamship companies to advance the ocean rates from the Continent to Galveston slightly over those to New York, the rate to both ports now being the same. The diversion so far has not been very great, only about 50 emigrants destined for Union Pacific territory having come through Galveston. But it is to prevent what looks likes like a permanent diversion of this business, that prompt action is requested. The Southwestern lines seem determined to get a share of this traffic regardless of rates. A committee from the Emigrant Clearing House Association has been appointed to consider the matter.

The old Chicago & St. Louis Traffic Association has been reorganized. The Association will have jurisdiction over only Chicago-St. Louis competitive traffic. The roads included are the Wabash, the Illinois Central, the Burlington, the Chicago & Alton, the Vandalia and their connections. Into this organization is to be merged the Illinois Rate Association. Mr. Horace Tucker, at present traffic manager of the Chicago, Hammond & Western, will probably be chairman of the new organization. The headquarters will be in Chicago.

The Western Freight Association is to live. The Sante Fe and the Rock Island have suspended their notices of withdrawal and the Chicago & Great Western has never been out of the association. The presidents of the Western roads believe that, for the present, rates can be reasonably well maintained by this organization. They have agreed to restore rates generally to the basis in effect one year ago. The traffic offices are now working on the details of this restoration which it is hoped to effect by November 1.

The roads of the Central Passenger Committee have agreed to sell round-trip tickets at one fare for the benefit of persons going home to vote Nov. 3. The Western roads have refused to reduce rates for this occasion on the ground that more voters would be taken away from home, losing their votes, than would be brought home to vote. The Central Passenger Committee lines have also been authorized to run line excursions to Canton, O., tickets to be sold to individuals at the same rate as to parties.

The receipts of live stock at the Union Stock Yards, Chicago, for the month of September, were proportioned among the Western roads, in carloads, as follows:

RECEIPTS.

Roads.	1896.	1895.
Santa Fe	902	1,208
Chicago & Alton	1,083	954
Burlington	7,414	5,919
Milwaukee & St. Paul	3,579	3,537
Chicago & Northwestern	5,089	5,006
Chicago, Rock Island & Pacific	2,527	1,565
Chicago Great Western	1,051	611
Illinois Central	1,402	1,055
Wabash	958	1,035
Wisconsin Central	319	209
Other lines	549	841
Totals	24,873	21,940

The shipments by eastbound lines were as follows:

SHIPMENTS.

Roads.	1896.	1895.
Baltimore & Ohio	246	147
Erie	1,233	936
Chicago & Grand Trunk	1,618	1,457
Lake Shore & Michigan South	749	549
Michigan Central	684	7 7
New York, Chicago & St. Louis	159	173
Pittsburgh, Cincinnati, Chicago & St. Louis	68	28
Pittsburgh, Ft. Wayne & Chicago	802	735
Other lines	1,399	1 5 5
Totals	6,898	6,342

Total eastbound shipments by lake last week amounted to 92,343 tons, of which 80,735 tons were grain. Total rail shipments, exclusive of live stock, were 51,520 tons, compared with 63,993 tons for the preceding week, a decrease of 12,473 tons, and against 88,398 tons for the corresponding week last year. The rail traffic was distributed among the roads as follows:

Roads.	Week to Oct. 10.		Week to Oct. 3.	
	Tons.	p. c.	Tons.	p. c.
Michigan Central	5,460	10.6	5,573	8 7
Wabash	3,838	7.5	6 491	10 1
L. S. & M. S.	5,665	11.0	7,710	12 1
Pitts., Ft. Wayne & Chicago	4,714	9.2	5,349	8.4
Baltimore & Ohio	5,472	10.6	8,112	12.7
Pitts., Cin., Chi. & St. Louis	4,751	9.2	5,8 3	9.1
Grand Trunk	4,969	9.6	7,010	11 0
N. Y. C. & St. L.	7,438	14.4	6,583	10.3
Erie	7,099	13.8	7,519	11 7
C., C., C. & St. Louis	2,114	4.1	3,797	5.9
Totals	51,520	100.0	63,993	100.0

Of the above shipments, 2,389 tons were flour, 22,039 tons grain, 11,878 tons provisions, 8,229 tons dressed beef, 1,643 tons butter, 1,210 tons hides and 2,426 tons lumber.